A Report on the Scientific Work of the Surgical Staff of the Woman's Hospital in the State of New York

1923 - 1924

Fig. 4. Case II. Replacement of kidney tissue with fat.

Med.
W.

REPORT

OF THE

Scientific Work of the Surgical Staff

OF THE

Woman's Hospital in the State of New York

Edited by GEORGE GRAY WARD, M.D., F.A.C.S.
Chief Surgeon

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FOREWORD

Again, through the generosity of the Board of Governors, the Surgical Staff of the Woman's Hospital is able to publish this volume of collected scientific contributions which are the result of work during 1923 and 1924.

This is the fifth volume of the series, and consists of 27 monographs by the staff, and seven theses by senior students of Cornell University Medical College on clinical problems that they have worked upon as a required part of the elective course in gynecology at the Hospital.

All the Surgical Staff are expected to utilize their valuable opportunities in the Hospital by engaging in clinical research and making studies from our records. These records are becoming increasingly valuable, owing to the greater care in their compilation which is now taken as a result of the hospital standardization movement.

The sincere thanks of the Staff are due to the Board of Governors for making this volume possible, and I also desire to express our appreciation for the courtesies received from the publishers of the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY, SURGERY, GYNECOLOGY AND OBSTETRICS, and the JOURNAL OF UROLOGY. Our thanks are also due to Dr. George W. Kosmak, editor of the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY for his aid in facilitating this publication.

GEORGE GRAY WARD, M.D.

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THE VALUE AND NEED OF MORE ATTENTION TO END-RESULTS AND FOLLOW-UP IN HOSPITALS TODAY*

By George Gray Ward, M.D., F.A.C.S.
(Chief Surgeon)

SINCE the inauguration of the hospital standardization movement by the American College of Surgeons in 1918, I have been interested in the subject and I have been fortunate in having unusual opportunities to put into practice the principles involved.

Sufficient time has now passed to enable us to begin to appraise the results obtained with precision. This appraisal shows in an indisputable manner the inestimable value of the proper study of our end-results, and the more we study our end-results the more apparent is the very great need of such an accounting.

First, I am going to tell you how we carry out the follow-up idea in the Woman's Hospital in New York. We have four divisions of gynecology and one division of obstetrics. Each division has its follow-up clinic once a week, which *must* be attended by the surgeon in charge of the division and his assistants. It is not optional.

Definite rules are laid down for the study of our end-results; simple laparotomies, hysterectomy for fibroids for instance, are kept under observation two years. They come back four times the first year and twice the second year. The plastic cases, as for prolapse and so forth, we find require more extended observation and we keep them under observation for a period of three years. They come back four times the first year, twice the second year and twice the third year. Minor cases are kept under observation for a shorter period of time, and the cancer cases are kept as long as we possibly can keep them. At the end of the period of observation the cases are examined and classified as successful, partially successful, or failures, and discharged out of the follow-up. That classification is not based on the anatomical result of the operation, but upon whether the woman was cured of the complaint for which she sought relief. One may have a beautiful looking result as far as the appearance of the operative wound is concerned, but the woman may still have her backache or other complaint. That is a failure.

Each one of the follow-up clinics reports every four weeks in the staff conference. We have a weekly staff conference every Thursday afternoon which takes an hour, so that every week one of the divisions is re-

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porting. They report the total number of cases seen during the past four weeks and how they have been classified. We pay no attention to their successes, but their failures and partial successes must be accounted for, the end-result cards being presented and the surgeon explaining why he classified a case as a partial success or a failure. (See Fig. 1.)

Woman's Hospital in the State of New York
END-RESULT CARD

Name	Address	History No.
Change of Address		Referred to Hospital by
Name and Permanent Address of Friend		Surgeon
Age S. M. W.	Date of Admission	Date of Operation Date of Discharge
Came for Relief of:		**Pathological Diagnosis**
Preoperative Diagnosis:		**Final Diagnosis**
Operation		**Important Points, Convalescence, and Discharge Note:**

FIG. 1

The Obstetrical Division also has a follow-up. Their problem is different from the gynecological problem. We cannot expect to have postnatal cases come back for any such long extended period, and it is not necessary or practical, but we *can* get them to come back for three months and, therefore, in the obstetrical follow-up the mother and the baby report once a month for three months. If the mother is not able to bring the baby, the condition of the baby is accounted for by the mother, so we get three visits postnatal in the obstetrical follow-up and

Woman's Hospital in the State of New York
END-RESULT CARD
OBSTETRICAL DEPARTMENT

Name	Address	Para	History No.
Change of Address			Referred to Hospital by
Name and Permanent Address of Friend			Surgeon
Age S. M. W.	Date of Admission	Date of Delivery	Date of Discharge

Previous Obstetrical History			Infant
Character of Pelvis and Soft Parts			Previous History
Character of Pregnancy			Weight at Birth
Character of Labor			Weight on Discharge
Character of Puerperium			Condition on Discharge
Operation			Condition at End of First Month
Final Diagnosis			Weight
Discharge Note:			Umbilicus
Pelvic Floor	Ant. Vag. Wall		Genitals
Uterus	Cervix		Eyes
Adnexæ	Breasts		Breasts
			General Condition

FIG. 2

they are then discharged with their classification. If there is a post-natal displacement of the uterus, or lacerations, etc., the patient is naturally referred to the Gynecological Department. (See Figs. 2 and 3.)

END-RESULTS

At each examination state condition of Breasts, Abdomen, Pelvic floor, Ant. and Post. Vaginal Walls, Uterus, Cervix, and Adnexæ; also give complaints and treatment.

First Month Date	
Second Month Date	
Third Month Date	

FIG. 3

When I first went to the Woman's Hospital the follow-up was there, but it was really a follow-up only in name as far as any valuable conclusions could be drawn from the findings, because the attending surgeons in charge of the divisions rarely saw the cases that they had operated upon. The assistants conducted the follow-up, and you can well imagine they would be rather wary of criticizing their seniors if sometimes they got poor results.

Upon establishing the rule that the surgeon himself must examine all cases, there was an immediate improvement in the attendance of over 100 per cent. The success of follow-up, in my opinion, rests upon that one thing—that the surgeon who operated is the one who is going to examine the patient. If the patient knows that she is going to see the doctor who operated upon her, she will come back but she will not come back with the same readiness if an interne or an assistant is going to pass judgment upon her.

Of all our cases last year there were only 15 per cent that refused to come back for the follow-up.

In addition to the usual follow-up and end-result study, I believe there should be special studies of end-results made in order to establish standards for comparison and check-up of our results.

Our records are a mine in which lie hidden vast treasures of information waiting to be excavated. For instance, a standard should be established as to what is an allowable mortality in simple hysterectomy for fibroids in order that our work may be compared with others. We should have standards of hospital operative morbidity in order that we may know if our patients are recovering properly.

I will give some instances of what I mean by the special end-result study from the improved records which we now have, due to this wonderful hospital movement.

As an example you may have a study of the mortality and infection of your staff. I hold that every hospital should have a study made and

kept carefully year by year. If you will have graphic charts made, like a temperature chart, of each man's mortality percentage year after year and let them all be on the same chart for comparison, you can get your composite average of the staff as to what your mortality in that hospital is. Any marked deviation from that above the average line will naturally call the attention of that surgeon to the fact that something is wrong.

Of course, there must be an extended period of observation before you can make any just comparisons; it would not do for a short period of time because a run of cases might throw a great many serious cases in that particular man's hands; but year after year, with a general even distribution of the service, his mortality should not be very much higher than that composite average.

The same is true of the infection percentage. The infection percentage is an interesting thing to study, and in order to study it I found it necessary to institute a special record of the healing of the wounds in our history system, and I have, therefore, a sheet called the "wound record." It simply records whether the operation was a clean one, or whether it was contaminated at operation from pus or not. It shows the nature and character of the drainage if there was any, and the number of removable sutures that were placed in the wound. Every time the wound is dressed or inspected it must be recorded and the man who does it must sign his name to it.

For instance, in abdominal wounds the first dressing, we will say, is made at the end of the seventh day, primary union recorded and the sutures perhaps cut, the second dressing probably at the end of the tenth day and the sutures removed; and it is indicated so that you know that the same number of sutures that were put in were taken out, and the final inspection of the wound is made and the condition recorded when the patient is discharged at the end of her stay in the hospital. As the surgeon signs the case out, which he must do, he must state whether the healing was by primary union, or if not, what the trouble was. The same record is kept of the vaginal wounds and there is space on the back of the sheet for the recording of repeated dressings in infected cases. (See Figs. 5 and 6.)

It is perfectly easy, with these data in every history, to make out the infection percentages of the staff.

A second example of special end-result study would be a study of the healing of wounds with various technics. I have had one of my staff in the hospital, Dr. Byron Goff, make such a study, which he has just completed, of the healing of three thousand wounds. The results of this survey have shown that it was very necessary for us to have a standard whereby we could make our classifications.

We have decided upon the following classification of the healing of wounds.

Class A is a complete primary union without any defects whatsoever.

WOMAN'S HOSPITAL, NEW YORK

CLASSIFICATION OF WOUND UNION

CLASS A.

Wounds Which Unite by Primary Union

Any break in the union of a wound excludes it from Class A.

Any discharge of blood, serum or fatty material which occurs after the tenth day excludes a wound from Class A.

CLASS B.

Wounds Which Do Not Unite by Primary Union Because of Minor Defects Such as:

1. Slight infection.
2. Slight degree of fat necrosis.
3. Small hematoma.
4. Slight stitch hole infection which involves the line of union of the wound.
5. Collection of serum discharged after the tenth day.
6. Slight separation of the tissues.
7. Slight degree of pressure necrosis.
8. Cigarette or tube drain following the removal of which the wound heals promptly by granulation without infection or with only slight infection.
9. Cigarette or tube drain plus slight infection about the drainage tract.
10. Foreign body (unabsorbed suture material, etc.), following the removal of which the wound heals promptly by granulation with or without slight infection.

No case which has been detained in the hospital one or more days because of the condition of the wound is to be placed in Class B.

CLASS C.

Wounds Which Do Not Unite by Primary Union Because of Major Defects Such as:

1. Extensive infection.
2. Marked degree of fat necrosis.
3. Large hematoma.
4. Extensive stitch hole infection which involves the line of union of the wound.
5. Wide separation of the tissues, with or without partial evisceration, which results in prolonged healing by granulation with or without infection.
6. Marked degree of pressure necrosis.
7. Cigarette or tube drain, following the removal of which the drainage tract heals by prolonged granulation without infection.
8. Cigarette or tube drain plus extensive infection about the drainage tract.
9. Foreign body (unabsorbed suture material, etc.), causing a sinus along which there is prolonged granulation or infection.
10. Intestino-abdominal or vesico-abdominal fistula.

All cases which have been detained in the hospital one or more days because of the condition of the wound are to be placed in Class C.

Small rubber tissue or silkworm-gut drains placed in fat of the abdominal wall are not to be considered causes of faulty union.

Fig. 4.

Class B is a wound which did not unite by primary union because of a minor defect.

Class C is a wound which did not unite by primary union because of major defects. To determine what goes in Class A, B, or C, the rule

is that no case which has been retained in the hospital one or more days because of the condition of the wound is to be classed in Class B. In other words, if that patient's convalescence has been delayed by the incision not healing properly, we do not put it as a minor defect. If she has lost time and the hospital has lost time, she goes in Class C, and

Woman's Hospital in the State of New York

WOUND RECORD

Name _____ Record No. _____

ABDOMINAL, LUMBAR or BREAST WOUNDS

Site _____ Operation _____ Date _____

Was wound contaminated at time of operation? _____

Drainage _____ Removed on _____ By Dr. _____

Number of Removable Sutures _____ Removed on _____ By Dr. _____

Wound Healed by _____ Cause of Failure to unite by Primary Union _____

Condition of Wound on Discharge _____ Surgeon _____

Date	Condition of Wound	Organisms	Character of Dressing	Dressed By

VAGINAL WOUNDS

Site _____ Operation _____

Drainage _____ Removed on _____ By Dr. _____

Number of Removable Sutures _____ Removed on _____ By Dr. _____

Wound Healed By _____ Cause of Failure to unite by Primary Union _____

Condition of Wound on Discharge _____ Surgeon _____

Date	Condition of Wound	Organisms	Character of Dressing	Dressed By

Record Additional Dressings on Reverse Side of Sheet

Fig. 5.

all cases which have been retained in the hospital for one or more days on account of the condition of the wound are placed in Class C. We have found that with this rigid classification—we have a percentage of the healing of all wounds, clean and contaminated, of approximately 90 per cent plus. (See Fig. 4.)

This study of 3,000 clean wounds showed that delayed union from all causes resulted in 1,584 extra days' stay in the hospital. Just consider

the economic importance of this to the hospital from the financial standpoint, where it costs four or five dollars a day to keep free cases in the wards, and also the loss of time to the patient.

As another example of special end-result study, we have endeavored to establish the standard of normal postoperative convalescence, in order

ABDOMINAL, LUMBAR or BREAST WOUNDS

Date	Condition of Wound	Organisms	Character of Dressing	Dressed By

VAGINAL WOUNDS

Date	Condition of Wound	Organisms	Character of Dressing	Dressed By

Fig. 6.

that we might judge of the normal postoperative morbidity. We made a study to determine the postoperative leucocytosis, polynucleosis and the temperature in a series of clean laparotomies. In one series for a period of nine and ten days, we had the postoperative blood counts taken every day and in another series every hour for twenty-four hours, in order that we could establish a standard and map graphic charts. It was a most interesting and valuable piece of work and was made by

two of my fourth year undergraduate students at Cornell University.

As to the value of end-result studies, they should be particularly directed to the determination of the physiologic rather than the anatomic results. They are of great value to the patient, to the surgeon and to the hospital—for the patient the mortality and morbidity are reduced; for the surgeon his illusions are dispelled; and for the hospital greater economy and consequently larger activities. The days saved to the patient and to the hospital by more speedy convalescence mean money saved to both the patient and the hospital.

The economic value of end-result study is incontrovertible. The surgeon becomes more proficient and is stimulated to greater efforts and to the correction of faults.

As to the need of end-result study, there is the same need for auditing our surgical results as there is need of auditing our finances. There is a need to establish standards for comparison of results, and this auditing is needed by the leaders of the profession just as much as by the rank and file.

In my opinion, the greatest need of the surgical profession today is the development of a surgical conscience. Very, very often our surgical conscience lies dormant, lulled into a peaceful slumber by the droning of tradition and the warmth of self-satisfaction. It needs but to be awakened by the stimulus of light in order to function to its fullest extent in carrying out the Golden Rule. That light can only come from an honest auditing of our surgical results. A good beginning has been made, but patience, persistence, and publicity are necessary in this propaganda.

I wish to take this opportunity to pay a tribute to Dr. Codman by expressing my great appreciation of the wonderful work and great good that he has accomplished by his fearless insistence on our recognition of the great need of end-results study in our hospitals today. He has been the means of saving many lives, much suffering, and much money.

RENAL PAPILLOMATA AND URETERAL IMPLANTS*

Their Surgical Treatment in the Female; with Report of a Case

By Dougal Bissell, M.D., F.A.C.S.
(Attending Surgeon)

MY object in reporting this case of primary renal and secondary ureteral papillomata is not merely to add another case to the literature but to show, first, the important relationship between a primary renal pathology of this character and a subsequent similar development along the urinary tract and, second, to show that when there exists primary renal papillomata with no evidence of secondary lesion in the ureter, there arise the questions: Should nephrectomy then alone be done and evidence of secondary involvement in the ureter awaited before ureterectomy is performed? Should nephrectomy be done followed by the removal of the remaining portion of the ureter at the earliest possible date? or should nephro-ureterectomy be done immediately? Likewise the question of preferred approach in finding and removing the ureter will be discussed and a new transperitoneal or intra-abdominal technic described applicable to ureterectomy in the female by which the ureter or its remaining portion may be removed without necessitating an excision of the bladder wall and with the least possible risk of peritoneal contamination from the bladder contents.

HISTORY OF CASE

In an unmarried woman thirty-one years of age, seemingly in perfect health, there occurred on February 15, 1923, a sudden and profuse hematuria which continued with lessening severity for several days. She was admitted to the Woman's Hospital on February 17. Examination revealed a red count of 3,516,000; hemoglobin 70 per cent. Cystoscopic examination showed the bladder and mouth of each ureter normal; a roentgenogram of the kidneys and ureters showed a bulging outline of the pelvis of the right kidney suggestive of some growth in the renal pelvis; as the blood picture did not improve on rest and diet, it was considered best to transfuse her before undertaking so radical an operation as nephrectomy. On March 9, 1923, 500 cubic centimeters of blood were given by the direct method and four days later nephrectomy was performed. The kidney with 5 centimeters of the upper portion of the ureter was removed without difficulty, and the remaining portion of the ureter within view was inspected; no evidence of growth was noticed. The severed distal end was tied with plain catgut, cleansed with carbolic acid and alcohol, and dropped into the wound. Healing was primary and an uneventful convalescence followed until the fourteenth day. Then the patient developed characteristic symptoms of phlebitis, i.e., chill, temperature, and pain in the left leg and during the following ten days there occurred four distinct embolic attacks in different parts of the body.

*Reprinted from *Surgery, Gynecology and Obstetrics*, March, 1925, pp. 323-333.

After three or more months' rest, the patient returned to her work apparently in perfect health. No cystoscopic examination was made between the time of operation and the subsequent history to be related. On November 12, or eight months after operation, there again occurred a sudden and profuse hematuria. Cystoscopic examination now showed a papillary growth completely encircling the orifice of the right ureter; an unsuccessful effort was then made to pass a catheter into the ureter through this growth—for this reason no x-ray picture of the ureter could be obtained; but from the extent of hemorrhage which occurred, it was believed that a greater papillary involvement existed in the upper portion of the ureter than was seen at the vesical orifice; therefore, the removal of the remaining portion of the ureter was determined upon. On November 20, 1923, this was done.

Fig. 1.—Malignant papillomata of the kidney pelvis. Roentgenogram showing dilated pelvis and upper ureter.

Operation.—A median longitudinal incision was made extending from the symphysis to the immediate region of the umbilicus. On opening the peritoneal cavity, the corpus uteri was found in first degree of retroversion, the adnexa were normal. To maintain the corpus in an extreme anterior position in order to facilitate deep pelvic manipulation of the ureter, catgut was passed in the form of a loop, through the posterior surfaces of the corpus near its juncture with the cervix, the free ends were carried out through the lower angle of the abdominal wound and there held taut by an assistant. The patient was now placed in the Trendelenburg posture and rubber envelope pads were used to keep the intestines out of the operative field.

Freeing and removing the abdominal portion of the ureter.—If the ureter cannot be located by sight or touch, as is done when it is tuberculous or when a palpable growth exists in it, then the surgeon must depend solely upon his knowledge of regional anatomy to locate and find the organ; this is not a difficult task when the right ureter is sought but it is when the left ureter is the object of attack. When the right ureter is to be removed, as in this case, the peritoneum should first be grasped with two Allis clamps a little to the outer side and just above the right common iliac artery; the forceps grasp the peritoneum here parallel with the general direction of the ureter and at a distance of one centimeter apart. Gentle traction is made upon them so as to elevate

Fig. 2.—Longitudinal section of kidney and upper ureter. The papillomata completely fills the kidney pelvis and distends the upper ureter.

the peritoneum over the fascial sheath through which the ureter passes. The peritoneum is never attached to this fascial sheath unless some inflammatory process has taken place in the ureter and when this occurs the course of the ureter is easily outlined because of the thickening of its walls; the problem then of finding it is not difficult. Between the two Allis clamps, the peritoneum, now elevated in the form of a tent, is cut with scissors at a right angle to the fold; when this incision is properly made there is a retroperitoneal area exposed in the region of the ureter about two centimeters long not parallel but at a right angle to the direction of the ureter so that even though the forceps may not have grasped the peritoneum immediately over the ureter, the ureter will be exposed through this cross incision when the forceps are released and the

peritoneum assumes its position. With this exposed portion of the ureter as a starting point, the organ is freed and followed upward under the ascending colon by sense of touch to its termination. Bleeding is insignificant, for all vascular connections are severed at time of nephrectomy. As the pelvic portion of the right ureter is easily accessible, the freeing of it is rendered comparatively easy. Hemorrhage is here practically nil as there are no vessels of importance met with until we reach the immediate region of the bladder when a branch from the uterine artery which constitutes the lower source of the ureteral blood supply is encountered and automatically cared for when the uterine artery is ligated and severed as was done in this case. If the uterine artery is not severed, and its severance is not necessary, though it facilitates the

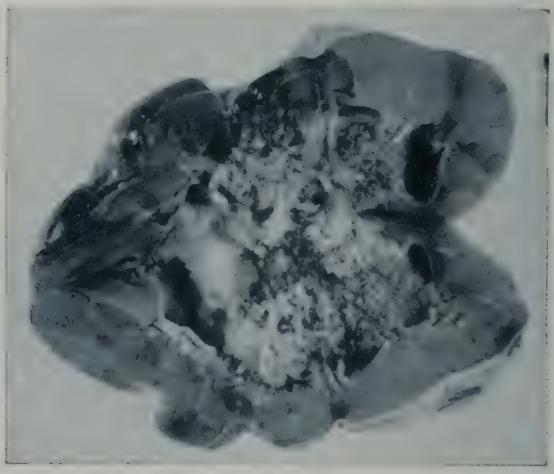

Fig. 3.—Kidney laid open longitudinally. Photograph showing the kidney pelvis crowded with papillomata and a small uninvolved area in upper angle of pelvis. (It is interesting to note that this extensive involvement occasioned only one hemorrhage, quite severe, lasting about three days.)

freeing and removal of the vesical portion of the ureter, this arterial branch is individually tied.

Freeing the vesical portion of the ureter in part through the abdominal cavity.—The lumbar and pelvic portions of the ureter now being freed, the problem before us was to remove the vesical portion with the least possible injury to, or sacrifice of, the musculature of the bladder, and to expose the peritoneum to the least possible risk of contamination from the vesical contents. The general plan of attack was to free the vesical portion from its muscle bed as far into the bladder wall as possible, then to separate the anterior vesical wall from its pubic attachment; enter the bladder by a longitudinal incision through its anterior wall; excise the growth at the ureteral outlet by a circular incision of the bladder mucosa, extending safely beyond the limits of the growth, and follow the ureter downward, dissecting it from its muscle bed until that

portion was met with which had been freed through the abdominal approach, and finally to remove the ureter through the tunnel made in the bladder wall.

If the removal of the vesical portion is attempted without adequate vision and space in which to manipulate, danger of hemorrhage is encountered from the uterine plexus and of contamination from the vesical

Fig. 4.—Drawing showing metastatic papillomata occurring in the extreme lower and upper portions of the remaining ureter following nephrectomy and partial ureterectomy. (Discovered eight months after original operation.)

contents. Therefore, to afford better opportunity for surgical manipulation, a window was cut through that portion of the broad ligament between the uterine plexus and the round ligament, parallel to and near the lateral border of the uterus. At the base of this opening the uterine artery was found, tied, and severed. The freed portion of the ureter was pulled through the window in the broad ligament from behind for-

ward. This manipulation facilitated greatly the freeing of the vesical portion of the ureter from its muscle bed which freeing was extended into the bladder wall as far as possible.

The peritoneal cavity was then temporarily abandoned and in order to facilitate manipulation, a short incision was made to the right at the lower end of the abdominal incision and at a right angle to it; the attachment of the right rectus was severed, the bladder freed from its pubic attachment and entered through an incision extending almost the entire length of its anterior wall. A complete exposure and view of the interior of the bladder was thus obtained, the bladder mucosa was then incised at a safe distance from the ureteral growth; the normal tissue thus encircled was grasped with an Allis clamp in a manner to avoid injury to the growth that reimplantation of it might not occur. The remaining attached vesical portion of the ureter was now freed and removed with the pelvic portion of the ureter—left in the peritoneal

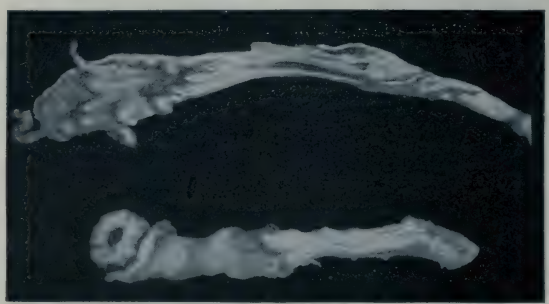

Fig. 5.—The lumbar portion of the ureter laid open showing a papillary growth in the distal extremity of the remaining ureter after nephrectomy.

Below, the pelvic and vesical protions of the ureter unopened showing the papillary growth at the proximal end of the ureter protruding into the bladder. It also shows a cuff of normal vesical mucosa surrounding the ureteral orifice and growth; likewise the section of ureter which passed through the musculature of the bladder.

cavity—through the tunnel made in the bladder wall.[1] The tunnel opening in the bladder was closed with three or four interrupted plain catgut sutures No. 1, and the anterior bladder wall incision closed with two layers of plain catgut sutures No. 1. The peritoneal cavity was then reentered; the posterior tunnel opening was closed with several interrupted catgut sutures, also the window in the broad ligament. A provisional drain was passed from the culdesac into the vagina to care for any possible leakage that might take place through the vesical tunnel; the right rectus was then anchored to its original site; the space of Retzius drained with rubber tissue and the abdomen closed; a Sims blocktin catheter was inserted into the bladder and removed on the eighth day; all evidence of blood disappeared after the third postopera-

[1]The papillary enlargement at the upper extremity of the ureter made it impossible in this case to deliver the entire ureter through the vesical tunnel; therefore, the enlarged portion was tied, severed, and removed independently.

tive day and the patient, apart from an infected wound, made a satisfactory recovery.

The plan adopted in this case has certain objectionable features which may be easily obviated—first, the removal of the vesical and pelvic por-

Fig. 6.—Shows the initial incision through the peritoneum to expose the ureter at the brim of the pelvis. Through the opening the ureter is followed upward and freed by blunt dissection with the finger and forceps, the peritoneum being incised as far upward as necessary. The incision of the peritoneum downward over ureter, as shown in insert, extends to base of broad ligament. A window is made through the broad ligament with ureter seen beyond.

tions of the ureter through the vesical tunnel exposes the peritoneum to possible contamination. To avoid this the vesical portion of the ureter, after being freed from behind, should be tied and severed and the posterior tunnel opening closed; second, the reentering of the abdominal

cavity, after working within the bladder, also exposes the peritoneum to contamination. To avoid this danger the intra-abdominal work should be completed and the peritoneal cavity closed before the vesical work is begun.

When the left ureter is to be removed, the peritoneum immediately above the pelvic brim and in close proximity to the inner border of the descending colon is grasped with two Allis clamps in the manner previously described. An incision is then made at a right angle to the peritoneal fold, care being taken not to injure the ovarian vein which is in close proximity, and the ureter is sought outwardly or immediately under the colon. The ureter is then freed and followed upward to its termination. As the left ureter passes down under the sigmoid there is

Fig. 7.—The freed ureter is being passed anteriorly through a window in the broad ligament.

necessarily a considerable amount of tissue encountered inwardly. This tissue should not be severed because it contains several important blood vessels. The ureter here must, therefore, be freed by sense of touch and brought out through an incision of the peritoneum at a lower point in the pelvis. The same technic is then followed in removing the vesical portion as previously described.

DIAGNOSIS OF RENAL PAPILLOMATA

It is not always possible, in fact it is usually most difficult to diagnose renal papillomata in incipiency. Pain is a late and not a constant symptom and is usually dependent upon passing of clots, crowding of the kidney pelvis or of hydronephrosis, the result of ureteral implantations obstructing the urine flow. Hematuria is as a rule the first sug-

gestive and recognized symptom but as hematuria may be a manifestation of other pathology in the urinary tract, cystoscopic examination, ureteral catheterization and pyelography are called upon to aid in diagnosing. When hematuria occurs the urine should be frequently and carefully examined for particles of papillomata which are from time to time thrown off in the urine stream.[1] If the bladder and ureteral orifices prove to be negative by cystoscopic examination, then the passing of a ureteral catheter will determine the side from which the hematuria occurs. The passing of a catheter may also serve to dislodge particles of the new-growth. Pyelography alone cannot be depended upon. It usually furnishes sufficient data, however, with the knowledge acquired

Fig. 8.—The ureter passed anteriorly through the broad ligament window. In this way the vesical portion of the ureter is approached directly. Traction on ureter, especially when the uterine vessels are cut (vessels not shown in this drawing) permits of easy approach and manipulation. Left insert shows lower portion of ureter freed from its bladder wall in greater part. Right insert shows sutures in position to close bladder wall and cover tied and severed end of ureter.

from the history of the case, cystoscopy, ureteral catheterization, etc., to base a surgical opinion upon.

PATHOLOGY

The profession is rapidly accepting the method determining the degree of malignancy of neoplasms first suggested by Broders in 1919. These lesions he divides "from the standpoint of cellular activity into 4 groups." The grouping is based upon the principle that the more the neoplastic cell tends to differentiate or approach the normal cell, the

[1]Dr. Plaut, pathologist to the Woman's Hospital, has personally reported the discovery of particles in the urine by which he was able to diagnose renal papillomata.

less the degree of malignancy. The great value of this contribution is that we are able to prognosticate with a degree of accuracy never before attained.

Dr. Broders kindly examined and classified the case here reported as belonging to the second group, which group he defines as containing "one-half differentiated cells and one-half undifferentiated cells." When considering the radical surgical work done in this case and the group into which it falls, the prognosis would seem favorable. Finally, it should be emphasized that Broders believes that all papillomata of the kidney, ureter, and bladder are of malignant nature, varying in degree. If, therefore, Broders' plan of classification be accepted, we must ignore the term papillomata, when it is met with in our statistical studies, and classify all as malignant.

IMPLANTS

In the case here reported it will be remembered that the papillomata found in the ureter, eight months after nephrectomy, was situated in the extreme upper and lower portions of the remaining ureter. The extent of growth, at the upper, was very much greater, however, than the lower portion, and it is probable that this upper and larger growth was the result of tying in particles of the renal papillomata which escaped into the ureter when handling the kidney on its removal. The lower implant, it is true, could have occurred at the same time or before, but being much smaller when discovered, the probability is that it originated from broken off particles of the upper papillomata which floated down the slow stream of purulent fluid with which the ureter was filled at the time ureterectomy was completed.

If the theory is correct that implantation is encouraged in a ureter apparently normal by manipulation of the kidney and the ligation of the ureter when nephrectomy is performed for renal papillomata, then it would seem rational, for this reason if not for the reason that microscopic implants may exist in the ureter at the time of operation, that not only the kidney but the entire ureter be removed; that if the entire ureter be not removed with the kidney at primary operation then the operator should not wait for evidence of recurrence in the remaining ureter but remove it entirely and as soon after the primary operation as the patient's condition will permit.

URETERECTOMY

When Henry Morris published, in 1901, his *Surgical Diseases of the Kidney and Ureter*, ureterectomy was of "quite recent date" and he defined the term as "partial or complete ablation of the ureter." Confusion does not arise when the term partial ureterectomy is applied to an operation in which only a part of the ureter has been removed, but

confusion does arise when the term complete ureterectomy is used where only a part and not the entire ureter has been removed.

Willy Meyer, writing about the same time, introduces an article on the subject with the statement that "total extirpation of the ureter means the removal of the entire canal from a point just below the pelvis of the kidney to its very entrance in the vesical wall."

Most writers since have accepted the definitions of these authors with the result that the term ureterectomy has been used in a very loose manner. It would seem apparent to any casual observer with a knowledge of the anatomy of the urinary tract, that as the ureter consists of three portions, namely, lumbar, pelvic, and vesical, to remove only one or two of these portions is to remove part and not the whole. The term ureterectomy, therefore, should be used only when we refer to the removal of the three parts or the ureter in its entirety as is our custom when we use the term nephrectomy, splenectomy and appendectomy to mean the complete removal of these organs. Any less removal should be designated as partial ureterectomy and the extent of the same described.[1]

The first recorded attempt at removing the ureter complete in the female was made by Howard A. Kelly,[2] March 30, 1893. In this case the removal of the vesical portion of the ureter was attempted through the vagina, six weeks after the removal of the kidney and the lumbar and pelvic portions of the ureter, but unsuccessfully. His second effort made several years later was, however, successful. In this operation he adopted the same retroperitoneal and vaginal technic but completed the nephroureterectomy in one sitting.

Bovee, Garceau, and other operators have since attempted the complete removal of the ureter by the combined retroperitoneal and vaginal route, but their results were not sufficiently satisfactory to warrant the continuance of this combined procedure. The difficulties met with by those who have attempted to remove the vesical portion of the ureter *per vagina* are hemorrhage, breaking of the ureter, and loss of the retracted end.

Dr. Howard A. Kelly is credited also with having performed the first complete nephroureterectomy in the female through the combined lumbar and transabdominal route. In the second case, Kelly removed a section of the bladder wall with the terminal ureter.

The history of surgery furnishes us with but few cases of complete removal of the ureter, primary or secondary, in the male or female.

[1]In regard to the term hysterectomy the gynecologist has acquired the same bad habit. This term means the complete removal of the uterus, yet when he wishes to describe an intra-abdominal amputation of the corpus he uses the term supravaginal hysterectomy which in reality means an abdominal hysterectomy, complete not partial.

[2]M. Poncet is credited by H. Morris with having been the first to remove at a single operation the entire ureter in the female, March 5, 1891. But Morris' definition of "complete ureterectomy" makes it extremely doubtful whether Poncet ever attempted the removal of the vesical portion of the ureter; and no mention of this particular feature is made by Morris.

NEPHRO-URETERECTOMY IN THE FEMALE

The retroperitoneal route for the removal of the kidney is universally adopted in both male and female, and its advantages are too obvious for discussion, but while the entire ureter in the male may be removed advantageously through this route, the question of its preference in the female is debatable.

In the male the ureter courses to the bladder without the complicating relationships met in the female and, therefore, as will be more specifically noted elsewhere, the approach to it by the retroperitoneal route is easier and safer than in the female.

Before discussing the advantages and disadvantages of the methods of approach when performing ureterectomy, it may be of interest to note briefly the varied technics which have been adopted when removing the entire ureter in the female. The early operations were done chiefly for the removal of the tuberculous ureter and are referred to in this article only because they bear upon the history of the complete removal of the ureter.

Dr. Howard Kelly, who was the first to attempt and first to remove completely the ureter in male or female, adopted, as previously stated, the combined retroperitoneal and vaginal routes. The objections to the vaginal route, for the removal of the vesical portion of the ureter, were demonstrated in the application of this technic by Kelly, Bovee, and Garceau already noted. To these objections may be added another, i.e., that when there occur papillomata protruding well into the bladder or involving its mucosa, the limits of the growth are most difficult to determine through the vaginal approach, and as a surgical involvement of them is to be avoided, this form of approach constitutes an objection.

Not satisfied with this combination of routes in removing the kidney and the ureter, Kelly, in 1901, employed both retroperitoneal and transperitoneal routes, in the first instance unsuccessfully, in the second successfully. After freeing the kidney and upper ureter, the kidney was forced down into the pelvic region, the abdomen was then opened in the median line, the pelvic portion of the ureter freed, the round and broad ligaments cut down to the bladder at a right angle to their general direction, the uterine artery tied and severed, and a resection made of that area of the bladder wall containing the terminal portion of the ureter; the kidney and entire ureter with a portion of the bladder wall were then removed through the abdominal opening.

The third nephro-ureterectomy technic was employed by Lower. This operation was done in two stages. Lower approached the kidney and upper portions of the ureter retroperitoneally and three months after removed the remaining portion of the ureter with part of the bladder wall retroperitoneally by extending the incision from the lower end of the old wound through which the kidney had been removed.

The fourth technic for the removal of the kidney and the ureter complete is that which I present in this article.

The first three methods present certain difficulties and objections which interfere with the execution of the work and by resecting the bladder from behind introduce elements of danger with respect to both infection and reimplantation of the new-growth. The fourth is direct and eliminates all dangers excepting that encountered when operating intra-abdominally for any form of pathology.

THE TRANSPERITONEAL OR INTRA-ABDOMINAL ROUTE

Attention was called by me, in 1903, to the advantages of the intra-abdominal route in ureteral surgery in an article describing a case of

Fig. 9.—A schematic drawing which shows the lumbar, pelvic, and part of the vesical portion of the ureter removed. The vesical portion with the papillary growth remaining was removed in the second stage of the operation suprapubically. Two sutures were passed at the peritoneal outlet of the vesical canal to close it.

ureterovesical grafting. In this article I stated that the transperitoneal or intra-abdominal route, permits the surgeon under all circumstances to discover the extent of ureteral injury, enables him to prepare the ureter to the best advantage for grafting and allows a selection of the most desirable point on the bladder wall for implantation; in fact it gives him the opportunity to execute his work with a clearness and precision afforded by no other route.

In 1908, I again called the attention of the profession to the advantages of the transperitoneal or intra-abdominal route in an article advocating the removal of calculi from the pelvic portions of the ureter intra-abdominally in the following paragraph: "Gynecological work of today

is chiefly intra-abdominal. The knowledge of pelvic pathology, familiarity with pelvic anatomy, and perfected technic makes the gynecologist especially fitted for intra-abdominal ureteral surgery. So well able is he now to protect the peritoneum that he should no longer hesitate to operate on the ureter within the abdominal cavity if by so doing he can insure an exactness not otherwise obtainable. Much of the work on the pelvic portion of the ureter has been done upon the female and our knowledge of ureteral anastomosing has been derived chiefly from this source. The results obtained have been most encouraging, yet we seldom designedly explore the ureter or remove, intra-abdominally, foreign bodies from it."

Again, in 1915, I published an article on the surgical treatment of the tubercular ureter in which I demonstrated the great advantage of the

Fig. 10.—A schematic drawing which shows the peritoneal and vesical closure of the canal from which the ureter was removed.

transperitoneal route in removing the pelvic and lumbar portions of the affected ureter. My convictions are just as strong now regarding the advantages of this method of approach and I feel justified in repeating what was then said in this connection, i.e., that "retroperitoneal surgery of the pelvic portion of the ureter in the female should be condemned as it is at best blind surgery and does not afford the safeguards at our command . . . that the transperitoneal route permits a direct approach and unrestricted access, and when pelvic complications exist, recognized or unrecognized, previous to operation they can immediately be corrected to advantage."

Of the many prominent writers who are strenuously opposed to the transperitoneal route, we find such men as Morris, Keen, Cheyne, Burchard, Fuger. Burchard objects on the ground that the ureters are

difficult to find behind the abdominal viscera unless they are altered considerably by disease, and in the event of leakage of urine from the ureter, the peritoneum may become infected, and the position of the wound does not permit a free drainage. Morris is of the opinion that the surgeon should, under no circumstances, approach the ureter transperitoneally. Fuger is of the opinion that intraperitoneal ureterectomy should be done only when access outside of the peritoneal cavity is possible. Since the arguments of Morris, Burchard, Keen, and others were advanced against the intra-abdominal approach, much has been learned in the art and science of surgery. But as the retroperitoneal approach is preferred by the majority of surgeons today, we must conclude that the arguments advanced by Morris and others hold good in the minds of those who advocate this route. Burchard considers that great danger is encountered in the possible leakage of infectious urine into the peritoneal cavity. Also that drainage of the wound is not possible. These objections when applied to the removal of the ureter down to the bladder junction are not valid for the reason that, when the ureter is so removed transperitoneally, the canal of the ureter is not entered except when the ureter is severed. When this is done by the technic herein described, the ureter is first tied above and below, then severed between with a knife first immersed in pure carbolic acid. Each cut end is then again cleansed with carbolic acid and alcohol, in the same manner that the appendix is handled when removing this organ. With regard to the danger of infection, there is in my opinion no greater danger, if as much, in removing the ureter intra-abdominally than in removing an unruptured appendix or pus-tube; in fact, we are constantly dealing with intra-abdominal situations which have greater possibilities of sepsis but from which we do not shrink; drainage through the posterior culdesac if deemed necessary, can always be easily established, as when the peritoneum is contaminated through any pelvic lesion.

McKechnie, 1912, in an article on ureteral surgery used practically the same argument in advocating the transabdominal route, as those advanced by me. McKechnie quotes Sinclair White and Densly as enthusiastic advocates also of the intra-abdominal route.

In spite of the successful results obtained by surgeons who have adopted the intra-abdominal route for operative work on the abdominal portions of the ureter in the female, yet, as McKechnie aptly puts it: "blind tradition still rules the realm of ureteral surgery."

The transperitoneal or intra-abdominal route, through the median abdominal incision, necessitates the least injury to tissue, and lessens the liability to infection and hernia. By the retroperitoneal route, there are encountered several important nerves, and in the female several blood vessels which may embarrass the operator in his work. By the transperitoneal route the ureter is approached directly, unless there should

TABLE I

COMPLETE REMOVAL OF THE URETER IN THE FEMALE

NAME	DATE	OPERATION	ROUTE	PATHOLOGY	STAGES	RESULTS
Kelly	'93 (first effort)	Nephro-ureterectomy	Retroperitoneal and vaginal	Tuberculosis, kidney and ureter	2	Failure to remove completely the vesical portion of the ureter.
Kelly	'95	Nephro-ureterectomy	Retroperitoneal and vaginal	Tuberculosis, kidney and ureter	1	Success.
Garceau	'97	Nephro-ureterectomy	Retroperitoneal and vaginal	Tuberculosis, kidney and ureter	1	Vesicovaginal fistula closed in 9 months
Bovee	?	Nephro-ureterectomy	Retroperitoneal and vaginal	?	1	?
Kelly	K & B 1901	Nephro-ureterectomy	Retro- and intraperitoneal	Tuberculosis, kidney and ureter	1	Death.
Kelly	1901	Nephro-ureterectomy	Retro- and intraperitoneal	Tuberculosis, kidney and ureter	1	Success.
Lower	1913	Nephro-ureterectomy	Reroperitoneal	Renal and ureteral neoplasms	2	Recurrent bladder growth. Treated Op. 2-8 and 19 Oct. with cautery in May. Growth almost disappeared.
Bissell	Mar. 1923 Nov. 1923	Nephro-ureterectomy	Retro- and intraperitoneal	1. Renal and 2. ureteral papillomata	2	Success. Mar. 17, no evidence of recurrent growth or neoplasm elsewhere.

exist as a complication some chronic or acute adnexal or appendiceal disease—under these circumstances intra-abdominal manipulation affords an opportunity to meet the situation intelligently, but if the approach is retroperitoneal the difficulties may become insurmountable. Because of the limited space afforded by the retroperitoneal route, management of the vessels of the infundibulopelvic ligament and those at the base of the broad ligament is difficult—for the same reason it is difficult to remove the vesical portion of the ureter from its muscle bed or resect accurately the bladder wall with its terminal ureter and papillomatous growth. By the transperitoneal approach we have more than ample space in which to manipulate, and the broad ligament, in the region of the cervix, though apparently an obstacle, in reality is not, as a window in it may be made at a point immediately above the junction of the ureter with the bladder wall affording ample view and room in which to work. The uterine vessels may thus be clearly defined and easily manipulated, severed or left *in situ*, thereby lessening the danger with respect to hemorrhage, and for the same reason the dislocation and management of the vesical portion of the ureter is done with greater ease and exactness.

CONCLUSIONS

That implants occur from above downward or in the direction of the urine stream and never from below upward unless by continuity; therefore, the urinary tract below the primary growth is peculiarly subject to this form of metastasis.

That when renal papillomata occur, the ureter of the affected side seems more susceptible to secondary involvement than does the bladder, and is usually affected prior to it.

That implants may occur anywhere along the ureter but are more liable to occur when there is retarded flow, as at the vesical orifice, or at points of injury, as when the ureter is severed and tied on partial removal.

That we are not justified in concluding, when nephrectomy is contemplated for renal papillomata, that the ureter is in its entirety normal because its vesical orifice seems not involved.

That as the ureter is susceptible to implants from the moment the primary growth above begins to throw off particles of itself, it should be considered a harbinger of danger, and as the ureter, under these circumstances, is a probable pathologic entity, it is advisable to remove it *in toto*.

That if the ureter is not completely removed at the time of nephrectomy, its remaining portion should be removed as soon after as the patient's condition permits.

That the best method of removing completely the remaining portion of the ureter is by the combined transperitoneal and transvesical route herein described.

PRELIMINARY REPORT OF PRIMARY CARCINOMA OF THE CERVIX UTERI TREATED WITH RADIUM IN THE WOMAN'S HOSPITAL IN THE STATE OF NEW YORK*

By Lilian K. P. Farrar, A.B., M.D., F.A.C.S.
(Junior Attending Surgeon)

IN February, 1919, the Board of Governors of the Woman's Hospital, upon the request of Dr. George Gray Ward, the chief surgeon of the hospital, purchased 250 milligrams of radium salt. The present report is based upon the use of this amount of radium in cases of cancer of the cervix uteri in the past six years and is presented by the kind permission of Dr. Ward with whom I am associated and under whose supervision all the ward cases come and who has directed the dosage and personally seen the cases in the Follow-up Clinic. The ward cases were from the beginning assigned to the first division in the hospital of which Dr. Ward is the attending surgeon, in order that the dose of radium should be uniform, and this report includes all the ward cases of cancer of the cervix treated with radium and also the private patients of Dr. Ward and my own patients, as I have employed the same dosage and technic. The private patients of other physicians are not included merely from the desire to know what the results are by the present methods of treatment. Radium alone, either in a tube or in needles or both together, has been the only treatment given the cases on which this preliminary report is based. A Wertheim operation has been done after irradiation in several cases but the follow-up end-results will appear in a later report. X-ray treatment together with radium, we have not used at the Woman's Hospital until the past six months and these cases are too recent to be included in this paper. This report, then, includes all classes of primary carcinoma of the cervix—the early, borderline or advanced, who were treated with radium alone.

The preparation and dosage are as follows: The radium salt is in a glass capsule (100 mg.) contained in a silver tube, which is in turn placed in a brass tube 1 mm. in thickness. This brass tube when ready for use is put into a rubber tube. We have found the rubber ink container of fountain pens to be of sufficient thickness (1 mm.), very inexpensive and of suitable length for use. The open

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end of the rubber tube is securely tied with two strands of braided silk approximately 16 inches long and these are tied to two strands of silk previously drawn through the eyelets in the brass tube, thus ensuring the recovery of the brass tube should by any chance the rubber tube be torn in removing the radium. After sterilization in alcohol for ten minutes of the rubber covered tube containing radium, the ends of the silk are tied to an 18 inch piece of ¼ inch gauze (which is to be packed in the cervical canal if wide enough to permit doing so) and this in turn is tied to a two yard strip of two inch gauze, which is

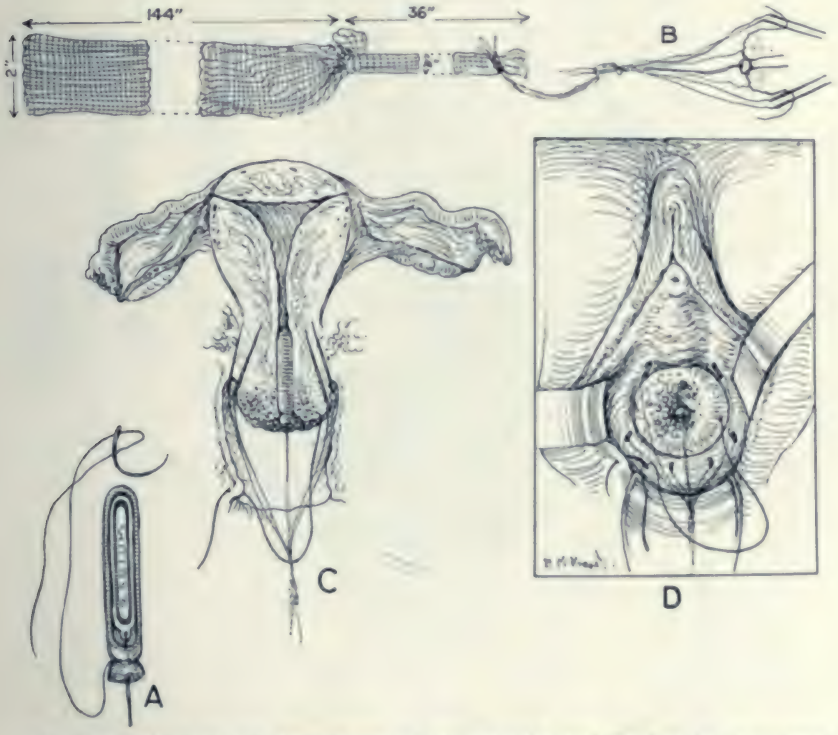

Fig. 1.—Technic of the application of radium tube and needles in carcinoma of cervix. *A*, radium salt in glass and silver capsule with 1 mm. brass and rubber screening. Note the tying of the silk threads, one with needle ready to anchor to tissues, and one attached to gauze packing. *B*, silk threads from tube and needles knotted together and tied to gauze packing. *C*, radium tube *in situ* in cervical canal and needles outside the cervix in adjacent tissue. Note anchoring suture passing through the cervix and vulva. *D*, front view showing needles under the bladder and in the uterosacral ligaments and in the broad ligaments posterior to the midline to avoid the ureters and blood vessels.

to be used to distend the vaginal canal. One of these strands of silk is threaded into a needle which passes through the cervix, after the tube containing the radium is placed against the carcinomatous growth in the cervix to ensure the radium remaining in position, and this strand of silk is held taut by the assistant while the vagina is tightly packed with the wide gauze to keep the bladder and rectum as far from the radium rays as possible. When the vagina is packed, this

silk is wiped carefully with iodine and fastened to the vulva orifice. The intern in removing the radium needs only to cut this stitch at the vulva and pull out the wide gauze, the narrow gauze must follow and then the radium; should the patient get out of bed before it is time for the radium to be removed the tube cannot be lost as it is

Fig. 2.—*A*, sagittal section showing the wide distention of the vagina with gauze packing and the position of radium tube with anchoring suture and radium tube and needles *in situ*.

securely tied to the vulva. The patient is prepared as for a vaginal operation and general anesthesia is given, usually nitrous oxide gas is sufficient. It is thought advisable to give a general anesthetic to facilitate a thorough examination of the pelvic organs, for frequently

what seems to be an early case of carcinoma is found to belong to the advanced class, and also to pack the vagina more fully with gauze as the freedom of irritability of bladder and rectum depends in great measure on the distention of the vaginal canal. Early in the use of radium we found the nurses were obliged to call an intern at night to remove the gauze packing in the vagina in order to catheterize the patients who were unable to void. We then placed a mushroom

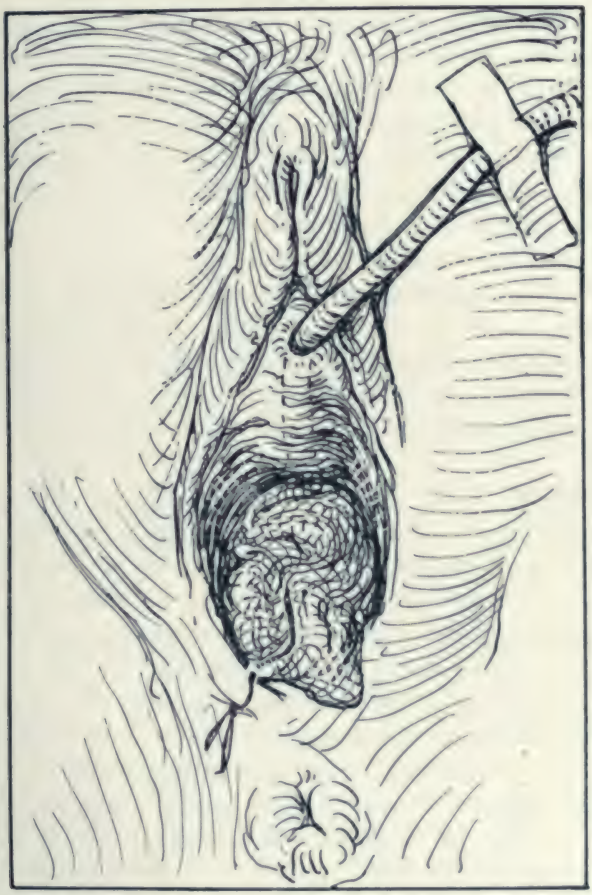

Fig. 3.—Showing the self-retaining catheter *in situ* and gauze pack in vagina.

catheter in the bladder when the radium was introduced into the cervix to keep the gauze undisturbed in the patient and the internes undisturbed in bed; with satisfaction to both parties.

A punch is used to remove several pieces of tissue for pathologic diagnosis before the radium is placed *in situ* and care is taken to injure the tissue as little as possible. It has been found by experience that cases treated with radium do better if preliminary care is given to the general health before administering the radium. If a patient

is suffering from anemia we have found it advisable to give a blood transfusion before the radium and if the general resistance seems low to try rest and tonic treatment for a few days previous to administration. There is always a local destruction of tissue by the radium and by throwing into the system more toxins a marked prostration may follow from which a patient is slow to recover. We permit patients to sit up as soon as the nausea is over, which is often when the radium is removed or the next day, and then let them get out of bed even though running a temperature, believing they have better drainage and absorb less by so doing. Douches of potassium permanganate are started the day after the radium is removed to flush out the purulent discharge and patients are told to douche daily after leaving the hospital. Patients are urged to live out of doors and make an effort to gain weight, as we believe the beneficial effect of radium depends in part on the general body resistance. There must be a comeback in the tissues to get results from radium.

Since our recent compiling of end-results the work of the radium follow-up cases has been placed under the direct supervision of the head of the Social Service Department and a card index is being made of the housing conditions of each patient. We believe a great deal can be accomplished in this way to get favorable results in the cancer cases.

Before I speak of the dosage, I would like to take a moment to consider the effect of radium salts on carcinomatous tissue and just what it is we hope to accomplish by giving a case of cancer of the cervix radium treatment, and upon what we base the dosage.

I will quote freely from a recent article, "An Analysis of Radiation Therapy in Cancer," by Dr. James Ewing who says, "One can extricate and emphasize one principle of radium therapy, viz., that radiation is capable of restraining the growth of tumor cells without causing either autolysis or necrosis"; and "Radium action is exerted on proliferating connective tissue. For the first time in the history of medicine we are in possession of an agent which will control the growth of connective tissue." * * * "From the study of much material, from operation and autopsy, in cases treated by deep radiation, I have become convinced that the clinical results are *not* usually due to the direct killing effect of radiation but are generally brought about indirectly and mainly by interference with the circulation—capillary, venous, arterial, and lymphatic. In many cases the main part of the destruction has been caused by occlusion of blood vessels."

In an admirable article by Dr. John Clark and Dr. Keene of Philadelphia, the healing process in the cervix after radium application is described as, "first, local destruction, then a considerable fibrous and tissue formation, with an ultimate condensation cicatrix followed by

more or less hyalinization." "To the latter process," Dr. Clark says, "we attribute the chief possibilities of a cure. To thrive, cancer requires vascularization on its frontier zone. A hyaline or fibrous barrier is, therefore, an effective block against the invasion of new blood vessels and serves excellently in the process of incarceration or segregation of malignant cells." Dr. Clark quotes Dr. McCarty of the Mayo Clinic as laying especial emphasis on the beneficence of the latter processes in the retardation or starving out of cancerous growths. We know that there are few blood vessels in dense scar tissue and in order that cancer cells should thrive there must be a sufficient blood supply at its border. Cut off that blood supply and cancer cells are isolated.

If we watch for six to eight weeks the clinical process going on in cervical cancer that has been treated with radium we see,

1. A hyperemia of the tissues.
2. A local destruction or breaking down of tissue and profuse purulent discharge with more or less absorption and possibly toxic symptoms if the destruction of tissue is great or the patient cachectic.
3. A local sloughing area in the cervix.
4. Diminishing slough in the cervix and a beginning healing process going on around the margins of the cervix.
5. Complete healing of the cervix which is now red and hyperemic, and there is now a complete disappearance of the slough.
6. Finally, complete cicatrization with marked contraction of the tissue of the cervix which is now shrunken, firm in consistency and pale in color. Until this stage is reached we do not consider the patient has had sufficient radium.

DOSAGE

The initial dose of radium has been 100 milligrams in a single tube placed within the cervix and left for twenty-four hours, with needles if there is involvement of the vagina, bladder or rectum. In young women under thirty in whom cancer cells are more resistant, the dose has been 100 milligrams for thirty to thirty-six hours. We have used this dose for all types of cancer cells and for all classes of involvement of the cervix by cancer, considering it to be merely a *therapeutic* or *test dose* and have been guided in subsequent treatments in the case by the result obtained by this initial dose. *Every case of cancer of the cervix is a study by itself.* There can be no uniform dose in successful treatment of cancer. Cases with the same type of cell and same stage of involvement by cancer vary greatly in their response to the initial dose. What is sufficient to cause a complete disappearance in one case and no recurrence for a five or six year period, is not sufficient to retard the growth for six to eight weeks in another case exactly similar to the first as far as the local lesion appeared. We know that radium has a selective action on tumor cells and that a dose of radium sufficient to hold in abeyance a malignant growth will not injure nor-

mal cells. We, therefore, do not try to give a killing dose to the tissues, believing, to quote Dr. Ewing again, "that ideal radium therapy seems to require a nice adjustment of relations between destructive effect on tumor cells and stimulation of stroma cells." "In further support of the view that radiation therapy tends to employ and support nature's method of healing" rather than by prolonged radiation to produce such extensive tumor necrosis that the patient dies from hemorrhage or septic absorption from the decomposition products of the tumor, producing, as Dr. Ewing states, those rapid terminal extensions of the disease which many observers have regarded as accelerations of growth from the stimulating effects of radiation.

A patient leaves the hospital usually at the end of a week, later, if her condition is not satisfactory, and reports to the Follow-up Clinic in one month; and from then on makes one visit each month to the clinic. If at the end of eight weeks from the first radium treatment a pale cicatrix has not formed or healing is not definitely progressing in the cervix, a second radium treatment is advised. The same dose is given or the dose is increased, according to the response of the initial dose, remembering that subsequent doses need to be greater to overcome the resistance offered by the scar tissue now formed in the cervix. In cases which do not show satisfactory retrogression of the cancerous involvement, we give a third or even fourth treatment, increasing the dose as seems advisable, and some of the best results have been in cases having several treatments. Perhaps the reason for this success may be, to quote again from Dr. Ewing, that "tumor tissues undergo progressive fibrosis but usually groups of tumor cells persist in the scar tissue and later give rise to recurrence." "When one proceeds in deep therapy on the theory that therapeutic results depend not only upon injury to tumor cells but also upon defense reaction of the body and the tissues, the immediate results seem to be almost equally striking, the end-result is often more satisfactory and the treatment is conducted with less damage and danger to the patient."

RESULTS

The cooperation of the patients in the Follow-up Clinic has been remarkable; over 90 per cent of the patients have reported regularly and of the remaining 10 per cent or less, the Social Service Department has been able to trace all but eight by home visits, visits to friends of patients, and by visits to the Board of Health to inspect the list of the death certificates for the year.

It is now six years since we first began radium treatment in the Woman's Hospital and from February, 1919, to February, 1923, 196 have been treated and deducting eight cases the number to be re-

ported on is 188. I have deducted the eight cases instead of calling them dead, as recently in reviewing our follow-up, six patients whom we had on the list as dead, as they had not reported in the follow-up in one and one-half to four years, walked into the clinic, every patient well and clinically free from carcinoma. So I have stopped "killing" them and will report only the cases seen, as being fairer to the statistics. Forty cases are in the two year period, twelve cases had radium and operation, and three cases were secondary carcinoma, so the number to be reported is 133. Since 1919, there are four periods of three years each and I will take up these three year cases, reserving the five year cases for the report to be given at the end of the month at the meeting of the American Medical Association as the list is not yet completed. This report includes all classes, grouped according to Schmitz' classification of primary carcinoma of the cervix uteri.

THREE YEAR END-RESULTS OF PRIMARY CARCINOMA OF THE CERVIX TREATED WITH RADIUM

	CLASSES I AND II. (OPERABLE)				CLASSES III AND IV. (INOPERABLE)				
Years	No.	Traced	Living	Per cent	No.	Traced	Living	Per cent	Total per cent
1919	11	10	4	40%	32	31	7	22.5%	26.8%
1920	7	7	7	100%	26	24	10	41.6%	54.8%
1921	9	8	6	75%	21	21	7	33.3%	44.8%
1922	7	6	6	100%	26	26	11	42.3%	53.1%
TOTAL	34	31	23	74.1%	105	102	35	34.3%	43.6%

All Classes I to IV, 133 cases traced, 58 cases living, 43.6 per cent total.

CONCLUSIONS

1. Every case of cancer of the cervix uteri should be studied individually.

2. The successful result does not depend entirely upon the direct killing of cancer cells but also upon the cicatrization of the cervix and occlusion of the blood vessels.

3. The first dose of radium should be a therapeutic dose.

4. The subsequent dose should depend upon the amount of healing and cicatrization seen six to eight weeks after the initial dose.

5. Repeated doses of radium may be necessary to arrest the tumor cells persisting in the cicatrix.

6. Since results of radium treatment depend also on the defense reaction of the body and tissues, every effort should be made to secure for the patient a favorable environment following the treatment; and especially have we found it advantageous to use blood transfusions as an aid to this end.

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611 WEST ONE HUNDRED AND TENTH STREET.

RADIUM TREATMENT OF CARCINOMA OF THE CERVIX UTERI

Results at the Woman's Hospital after Five Years*

By George Gray Ward, M.D., and Lilian K. P. Farrar, M.D.
(Chief Surgeon) *(Junior Attending Surgeon)*

IN the six years that we have treated cancer of the cervix with radium in the Woman's Hospital, we have based our treatment on the reaction of the neoplasm to the initial, or, as we prefer to call it, the therapeutic, dose as seen from six to eight weeks after the first radium treatment has been given. In a recent paper by one of us,[1] the technic of administering the radium and the clinical reaction as seen in the cervix for from six to eight weeks following the application is fully described. In brief, the initial dose given is from 2,400 to 3,600 milligram hours. The radium salt is in tubes, and radium needles are used when the paracervical tissues are involved. Until recently, needles were not used unless the case was a definite Class 3 or 4. We have lately employed needles more frequently in the cervicovaginal margins whether they are palpably involved or not. The subsequent dose or repeated doses depend on the retrogression of the tumor, and any evidence of reactivity in the cancer cells at a later period. We believe from our experience that these patients do better after irradiation if their resistance has been fortified by preliminary attention to their general health as far as the circumstances will allow. The associated anemia, which is frequent, can be markedly improved by a prophylactic blood transfusion in many cases, and it is our custom, whenever possible and necessary, to utilize this valuable aid. Five hundred cubic centimeters of blood administered a few days prior to the treatment will aid the patient to combat more successfully the toxins thrown into the system as a result of the local destruction of tissue by irradiation. The patients report once each month to the follow-up clinic, which we attend in person, and if in six or eight weeks after the first treatment the cervix does not show the contraction and pallor due to the development of scar tissue and occlusion of blood vessels resulting from sufficient dosage, a second treatment is advised, usually a repetition of the initial dose. Subsequent treatments depend on evidence of cell activity, and some of our most striking results have followed several irradiations.

It is important to point out that many of the subsequent treatments may only consist of implantation of needles in small suspicious areas that have developed since the previous inspection. We wish to em-

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phasize the point that we believe better results may be obtained if this monthly inspection is carried out as a routine by the surgeons themselves, and that vigilance will enable one to note *early* any sign of an exacerbation of the disease in the vaginal tract. The prompt application of the radium to such a suspicious area will stamp out the rekindling fire before it has gained a dangerous headway. We believe that we have prolonged the lives of some of our patients by this watchfulness—here eternal vigilance is surely the price of safety.

We do not believe that there can be a uniform dosage if we are to obtain the best results from radium. Every case of cancer is a study by itself, and we think that we have seen a considerable variation in the response to the initial dose in cases with the same type of cell and the same stage of the disease. As one of us[2] has pointed out in discussion elsewhere, it is not always possible to give a definite classification of the type of cell in every case, as frequently the types are mixed in various proportions and often in different sections of the same cervix. The tissue removed for examination may be of one type, while in another and perhaps preponderating area another type may be present.

The dosage sufficient to cause a complete disappearance in one case with no recurrence after five or six years may not be sufficient to retard or cause retrogression in another case of exactly similar pathologic findings and extent of the disease. We cannot see the advantage of giving several treatments at short intervals as done in some clinics, before a sufficient time has elapsed to judge of the effect of the first application to the tissues, as there is a great difference in the response of the growth to radium treatment; nor can we believe in the massive doses that destroy the normal cells and pave the way for a rapid extension of the malignant tumor. Rather are we in accord with the belief of Dr. James Ewing, as quoted in the preliminary report of our work, that one can extricate and emphasize one principle of radiation therapy, viz., that irradiation is capable of restraining the growth of tumor cells without causing either autolysis or necrosis, and radium action is exerted on proliferating connective tissue. For the first time in the history of medicine we are in possession of an agent that will control the growth of connective tissue. From the study of much material, from operation and necropsy, in cases treated by deep irradiation, Dr. Ewing[3] says he has become convinced that the clinical results are not usually due to the direct killing effect of irradiation but are generally brought about indirectly and mainly by interference with the circulation—capillary, venous, arterial and lymphatic. In many cases the main part of the destruction has been caused by occlusion of blood vessels.

The value of our method of treatment is what we are now trying to ascertain after having pursued this course for six years. In the first

years, operation and radium were used in combined treatment of twelve cases, and in the last six months we have employed the roentgen ray together with radium; but these cases are too recent to be included in this report. Our report, then, will endeavor to summarize our results of all cases treated by radium alone at the end of three years and of five years; those treated by combined radium and operation, and a total summary of this combined group with the pure radium series. The compiling of the statistics from our end-result cards, the radium record books, and the case histories has been done by Dr. Ralph L. Barrett of the staff. As Dr. Barrett was not connected with the clinic during the period covered by this report, his deductions are entirely impartial and have been unbiased by any personal equation.

It would seem desirable that some uniform method of reporting these statistics from the various clinics be adopted, if the full value of comparative studies is to be readily available. In studying the reports issued from time to time from the various clinics, this absence of uniformity is most striking and greatly complicates the problem.

We have used Schmitz'[4] classification for all our cases that we might more clearly define the stages of involvement, but we have substituted the word "secondary" for "recurrent" in the classification, believing that it will lead to less confusion of terms if the word "recurrent" is used only when it is intended to mean a renewed activity of the malignant cells whether after operation or radium treatment.

This report is based on the ward cases that have from the beginning of our radium treatment been assigned to the first division of the hospital, which is under our direct supervision and care, and also on our private cases. The private patients treated by other members of the staff have not been included on account of the variation of dosage and management.

We have based our percentages on the number of patients "living" after three and five year periods from the first treatment we have given. The total number of patients that we treated is 196, and of these all but eight have reported to the follow-up clinic or have been definitely traced and their condition known. We have deducted the missing eight rather than call them dead, believing this to be more nearly accurate, as recently six patients who had not been in the clinic in from one and one-half to four years returned as the result of a vigorous follow-up, each one in excellent health and clinically free from carcinoma. The total number of cases traced, then, is 188; 181 were treated with radium alone, twelve were treated by combined radium and operation, and three were secondary cases (recurrence after panhysterectomy for carcinoma of the cervix). Forty-two cases of the 196 are of but two years' duration or less, and will therefore not be included in this report. There are, then, 154 cases to be re-

ported: primary cases treated with radium alone, 139; primary cases treated with radium and operation, twelve; secondary cases treated with radium, three.

DEFINITION OF CLASSIFICATIONS

We have adopted Schmitz' classification:

1. *Primary Cases.*—Cases receiving initial treatment from us:

(*a*) Operable: Classes 1 and 2, limited to the cervix with no induration of paracervical tissue.

(*b*) Inoperable: Classes 3 and 4, any extension beyond cervix or induration of paracervical tissues.

2. *Secondary Cases.*—Cases recurring after panhysterectomy for cancer of the cervix.

It is of interest to note that in the series of 196 cases treated we found that carcinoma developed in the cervical stump left after a previous supravaginal hysterectomy in nine cases.

Mortality.—There were three deaths among the 181 patients treated by radium alone, or a mortality of 1.6 per cent.

Operability.—Five patients were refused radium treatment on account of evidence of distinct metastasis and marked cachexia. These, with the 196, make 201 cases. Of these, forty-eight were Classes 1 and 2, giving an operability of 23.8 per cent.

Table I shows the age incidence by decades. The youngest patient was twenty-six, the oldest, seventy-seven. There were eight patients under thirty years of age, or 4 per cent. Five of these patients died in one year, one in two years, and two are living, one after four years and one after five years.

TABLE I

AGE INCIDENCE

DECADES	NUMBER	PER CENT
20-30	8	4.0
30-40	45	22.9
40-50	67	34.1
50-60	48	24.4
60-70	20	10.2
70-80	8	4.0
Total	196	99.6+

Youngest, 26; oldest, 77.

RESULTS OF TREATMENT OF EIGHT PATIENTS UNDER 30 YEARS OF AGE, OR 4 PER CENT

CASE	YEAR	CLASS	TREATMENT	LIVED
1	1919	3	Radium alone	2 yr.
2	1919	2	Radium alone	1 yr.
3	1919	2	Radium alone	1 yr.
4	1919	3	Radium alone	1 yr.
5	1920	2	Radium alone	5 yr. (living)
6	1921	3	Radium alone	3½ yr.
7	1921	3	Radium alone	1 yr.
8	1923	3	Radium alone	1 yr.

Table II shows the incidence of fistula. Nine patients had thirteen rectovaginal or vesicovaginal fistulas at some time following radium treatment. Two of these fistulas have healed, leaving eleven permanent fistulas, either as the immediate result of radium or from the extension of the carcinomatous growth, an incidence of 5 per cent.

TABLE II

INCIDENCE OF FISTULA FOLLOWING RADIUM OR TERMINAL STAGE

(*a*) Primary

YEAR	CLASS 1 NO.	CLASS 2 NO.	CLASS 3 NO.	CLASS 4 NO.	HEALED NO.
1919	..	1	3(2)*	..	..
1920	..	..	1	..	1
1921	..	1	..	..	..
1922	..	..	1	..	..
Total	..	2	5(2)	..	1

(*b*) Secondary

YEAR	CLASS 1 NO.	CLASS 2 NO.	CLASS 3 NO.	CLASS 4 NO.	HEALED NO.
1919	..	..	..	..	..
1920	..	..	..	1	..
1921	..	..	..	1(2)*	1
1922	..	..	..	..	..
Total	..	..	..	2(2)	1

Total, 196 cases; 11 fistulas in 9 cases; 2 healed, 5 per cent.
*Two fistulas in one case.

Table III shows the three year end-results in cases of primary carcinoma of the cervix treated (*a*) with radium alone, (*b*) by radium and operation, and (*c*) secondary carcinoma treated with radium. The cases are arranged in classes from 1 to 4 according to Schmitz' classification. The number traced is given, the number living and the percentage for each year, then the total percentage of each, and finally the combined total percentage for all classes by radium or radium and operation. We will speak later of the operable cases, but now take up all classes together. In (*a*) the series of cases of primary carcinoma treated with radium alone, there were fifty-eight patients of all four classes living three years or longer, or 43.6 per cent. In (*b*) the primary carcinoma treated with radium and operation, there were twelve. These cases were largely confined to our earlier series, when a Wertheim or panhysterectomy was done after irradiation, but as our experience increased, it seemed to us that the method of treatment was open to doubt in view of the satisfactory results obtained with radium alone, although, in this series of eleven patients, 72.7 per cent were living three years or longer. In (*c*) the secondary cases treated with radium, we had no patient living three years; so the combined total percentage for primary and secondary carcinoma of the cervix or all classes treated with radium, or radium and operation living three years or longer, is 44.8 per cent.

TABLE III

THREE YEAR END-RESULTS; CARCINOMA OF THE CERVIX

Years	Class 1 Traced	Class 1 Living	Class 1 Per Cent	Class 2 Traced	Class 2 Living	Class 2 Per Cent	Class 3 Traced	Class 3 Living	Class 3 Per Cent	Class 4 Traced	Class 4 Living	Class 4 Per Cent	Total Traced	Total Living	Total Per Cent
(A) PRIMARY CARCINOMA; RADIUM															
1919	0	0	0	10	4	40	30	7	23.3	1	0	0	41	11	26.8
1920	0	0	0	7	7	100	24	10	41.6	0	0	0	31	17	54.8
1921	0	0	0	8	6	75	21	7	33.3	0	0	0	29	13	44.8
1922	1	1	100	5	5	100	26	11	42.3	0	0	0	32	17	53.1
													133	58	43.6
(B) PRIMARY CARCINOMA; RADIUM AND OPERATION															
1919	1	1	100	5	3	60	1	1	100.0	0	0	0	7	5	71.4
1920	0	0	0	0	0	0	0	0	0.0	0	0	0	0	0	0.0
1921	1	1	100	2	1	50	0	0	0.0	0	0	0	3	2	66.6
1922	0	0	0	1	1	100	0	0	0.0	0	0	0	1	1	100.0
													11	8	72.7
(C) SECONDARY CARCINOMA; RADIUM (FOLLOWING PANHYSTERECTOMY)															
1919	0	0	0	0	0	0	1	0	0.0	0	0	0	1	0	0.0
1920	0	0	0	0	0	0	1	0	0.0	0	0	0	1	0	0.0
1921	0	0	0	0	0	0	1	0	0.0	0	0	0	1	0	0.0
1922	0	0	0	0	0	0	0	0	0.0	0	0	0	0	0	0.0
Total													147	66	
Combined total percentages															44.8

TABLE IV.

FIVE YEAR END-RESULTS; CARCINOMA OF THE CERVIX

Years	Class 1 Traced	Class 1 Living	Class 1 Per Cent	Class 2 Traced	Class 2 Living	Class 2 Per Cent	Class 3 Traced	Class 3 Living	Class 3 Per Cent	Class 4 Traced	Class 4 Living	Class 4 Per Cent	Total Traced	Total Living	Total Per Cent	Combined Total
(A) PRIMARY CARCINOMA; RADIUM																
1919	0	0	0	10	3	30.0	30	5	16.6	1	0	0	41	8	19.5	
1920	0	0	0	7	6	85.7	24	3	12.5	0	0	0	31	9	29.0	
													72	17		23.6
(B) PRIMARY CARCINOMA; RADIUM AND OPERATION																
1919	1	1	100	5	2	40.0	1	1	100.0	0	0	0	7	4	57.1	
1920	0	0	0	0	0	0.0	0	0	0.0	0	0	0	0	0	0.0	
													7	4		57.1
(C) SECONDARY CARCINOMA; RADIUM (FOLLOWING PANHYSTERECTOMY)																
1919	0	0	0	0	0	0.0	1	0	0.0	0	0	0	1	0	0.0	
1920	..	..	..	..	..	...	1	0	0.0	0	0	0	1	0	0.0	0.0
Total													81	21		
Combined total percentages																25.9

Table IV shows the five year end-results of cases arranged in the same way as the previous table, except that there are only two series of five year groups. In (*a*) the series of cases of primary carcinoma of the cervix treated with radium alone, there were seventeen patients of all four classes living five years or longer, or 23.6 per cent. In (*b*) the cases of primary carcinoma treated by radium and operation, there were four patients living five years or longer, or 57.1 per cent. No patient with secondary carcinoma lived five years. The combined total percentage for patients with primary and secondary carcinoma of the cervix of all classes treated with radium or operation and radium living five years or longer is 25.9.

Table V shows the number of patients receiving more than one radium treatment. We believe that frequent inspection of the cervix and immediate application of radium to any suspicious area has checked recurrence of the malignant growth in many of our cases.

TABLE V

PRIMARY CARCINOMA OF CERVIX TREATED BY RADIUM ALONE; PATIENTS RECEIVING MORE THAN ONE RADIUM TREATMENT

YEAR	CLASS 1	CLASS 2	CLASS 3	CLASS 4	LIVING 3 YR.	LIVING 5 YR.
1919	0	3	16	0	5	4
1920	0	4	12	0	8	4
1921	0	1	13	0	4	—
1922	1	1	13	0	9	—
Total	1	9	54	0	26	8

SUMMARY

Total number of all classes of carcinoma of cervix treated with radium alone	139	
Sixty-four of these patients received repeated radium treatments at varying intervals, or		46%
Total number of all classes of carcinoma of cervix treated with radium alone living three years or longer	58	
Twenty-six of these patients received repeated radium treatments at varying intervals, or		44.8%
Total number of all classes of carcinoma of cervix treated with radium alone living five years or longer	17	
Eight of these patients received repeated radium treatments at varying intervals, or		47%

Of the 139 patients with primary carcinoma of the cervix receiving radium treatment, sixty-four, or 46 per cent, have received more than one application. Of the fifty-eight patients living three years or longer, twenty-six, or 44.8 per cent, received more than one irradiation, and of the seventeen patients living five years or longer, eight, or 47 per cent, had more than one irradiation.

Table VI shows the three year end-results of radium alone in operable cases (Classes 1 and 2). It is acknowledged, we think, that for the inoperable cases of cancer of the cervix, radium is preferable to surgery; but for the operable cases there seems still to be a great

difference of opinion. The comparison of radium with surgery should be, however, in the operable cases alone. The question is, should radium replace surgery in the operable case? The 20 to 25 per cent absolute curability by the radical Wertheim operation comes only after years of surgical experience and a high primary mortality in the early years while getting this experience, but the low mortality from radium treatment, and also the low morbidity, is in favor of radium only if we can get equal results with surgery. It is not the ease with which radium may be applied that we should consider, but what is the final result to the patient.

Table VI shows the cases of operable carcinoma by years. Of the patients treated in the first year, only 40 per cent were living three years later; but in two years of the series, 100 per cent were living

TABLE VI

RESULTS IN ONE HUNDRED AND THIRTY-NINE CASES OF PRIMARY CARCINOMA OF THE CERVIX TREATED WITH RADIUM ALONE OBSERVED THREE YEARS OR LONGER

YEAR	CLASSES 1 AND 2	TRACED	LIVING	PER CENT	CLASSES 3 AND 4	TRACED	LIVING	PER CENT	TOTAL PER CENT
1919	11	10	4	40	32	31	7	22.5	26.8
1920	7	7	7	100	26	24	10	41.6	54.8
1921	9	8	6	75	21	21	7	33.3	44.8
1922	7	6	6	100	26	26	11	42.3	53.1
Total	34	31	23	Operability, 24.4 per cent.					

Number of cases treated with radium alone 139
Number of operable cases treated with radium alone 34
Number traced 31
Number of these patients living three years or longer ..... 23, or 74.1%

three years or longer, and the total percentage of the four series showed that twenty-three, or 74.1 per cent, of the patients were living three years or longer.

Table VII shows the five year end-results of operable cases of carcinoma of the cervix treated with radium alone. Five years has been the time considered the test for absolute curability by the radical operation. In comparison of methods of treatment, surgery or radium,

TABLE VII

RESULTS OF SEVENTY-SIX CASES OF PRIMARY CARCINOMA OF THE CERVIX TREATED WITH RADIUM ALONE OBSERVED FIVE YEARS OR LONGER

YEAR	CLASSES 1 AND 2	TRACED	LIVING	PER CENT	CLASSES 3 AND 4	TRACED	LIVING	PER CENT	TOTAL PER CENT
1919	11	10	3	30	32	31	5	16.1	19.5
1920	7	7	6	85.7	26	24	3	12.5	29.0
Total	18	17	9	Operability, 23.6 per cent.					

Number of cases treated with radium alone 76
Number of operable cases treated with radium alone 18
Number traced 17
Number of these patients living five years or longer ..... 9, or 52.9%

the same time limit should apply. We have eighteen cases of primary carcinoma of the cervix treated with radium; seventeen have been traced. We may say that every effort has been made to locate the eighteenth patient by search in the records of death certificates by the board of health, but she is not there, so we have omitted this case, reporting those whom we have traced and know to be living five years or longer. In the first series (1919), three are living, or 30 per cent. In the second series (1920), six are living, or 85.7 per cent. The total number of patients with primary carcinoma of the cervix treated with radium alone living five years or longer is nine, or 52.9 per cent. If we count as dead the eighteenth patient, the percentage of living patients after five years is 50.

TABLE VIII

PERCENTAGES OF OPERABILITY, AND RELATIVE AND ABSOLUTE CURABILITY OF CERVICAL CARCINOMAS FOR DIFFERENT METHODS OF TREATMENT*

CLINIC	OPERABILITY, PER CENT	TOTAL NUMBER	TOTAL NUMBER	RELATIVE CURES	ABSOLUTE CURES	METHOD OF TREATMENT
Clark, J. G.	17.0	140	12	27.2	8.6	Radium
Bailey and Healy	22.0	155	17	26.4	9.2	Radium
Kehrer	45.7	129	36	40.7	27.8	Radium
Ward and Farrar	23.6	72	17	43.6 (3 yrs.)	23.6	Radium
Heyman†	....	217	44	....	20.2	Radium
Doederlein	32.6	755	103	30.3	13.2	Radium and Roentgen rays
Baisch	51.0	198	28	23.8	14.1	Radium and Roentgen rays
Schmitz	17.5	103	15	50.0	14.6	Radium and Roentgen rays
Johns Hopkins	52.1	387	102	46.5	26.6	Surgery
Stoeckel	70.6	350	98	35.4	26.6	Surgery
Graves	64.0	181	34	34.2	18.5	Surgery

*After Schmitz.

†Surg., Gynec. and Obst., February, 1925, xl, 161.

Table VIII presents the statistics compiled by Schmitz of radium results in several clinics by the use of radium, radium and Roentgen rays, or surgery.

CONCLUSIONS

1. We believe that the initial dose of radium should be a test dose to ascertain the reaction of the malignant growth and of the normal tissues to radium activity.

2. It has been our aim to give only a dosage sufficient to inhibit the tumor growth and to produce scar tissue in the cervix and adjacent structures. It is by this production of dense scar tissue that the blood vesesls are occluded and the cancer cells starved and isolated.

3. The surgeon himself should be acquainted with the clinical progress of the reaction to radium going on in the cervix.

4. Regular monthly visits on the part of the patient and personal inspection by the surgeon himself are absolutely necessary to check the renewed activity of the malignant growth in its incipience by subsequent radium treatment.

5. We believe that, if we succeed in arresting the progress of the disease by inhibiting the growth and walling in and imprisoning the cancer cells in cicatricial connective tissue, we are exposing the patient to a greater risk in opening up these barriers by the necessary trauma incident to a hysterectomy, and feel that we may do better for our patients if we rely on radium alone in view of our own statistics and those reported by other clinics.

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REPORT OF A CASE OF ACQUIRED ATRESIA OF THE VAGINA AND THE OPERATIVE RESULT*

By Hermann Grad, M.D., F.A.C.S.
(Attending Surgeon)

ACQUIRED atresia of the vagina from caustics, applied as a therapeutic measure, is very rare. The following case recently came under my observation.

Miss V., aged twenty-seven, consulted her physician about a leucorrheal discharge prior to her sailing for an extensive trip. Her physician told her that, as there would be no opportunity for a course of treatment he would make one strong application, the effects of which would wear off by the end of her ocean voyage.

Fig. 1.—Atresia vagina. Scar tissue in front of cervix uteri. Right hand figure shows side view.

Her physician made the application and she was immediately seized with great pain and had to go to bed. She suffered great pain all night and the next morning went aboard the ship on which she was sailing. During the entire ocean trip she remained in bed and was in constant pain. On landing she was sent to a hospital in London, where a diagnosis of carcinoma of the cervix was made and a specimen was taken for examination and was reported negative. Under local treatment and irrigation she improved rapidly and in ten days was able to leave the

*Presented at a meeting of the New York Obstetrical Society, October 9, 1923.

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hospital. There was no further vaginal discharge and she considered herself recovered.

When her next menstrual period came around she was taken with severe abdominal cramps but no flow occurred. This continued for six months. Previously her menstruation was perfectly normal. During August, 1923, she was obliged to go to bed for five days, with more pain than during the previous five months. She went to Paris and at the American Hospital was told that the only thing for her to do was to submit to a hysterectomy. She then came home and presented herself to me for examination. The latter revealed a short vagina with a complete atresia at the upper third; the cervix could not be palpated; the uterus appeared to be enlarged and the adnexa appeared to be normal. Further inquiry brought to light the fact that the patient had nitric acid applied to the uterus and cervix. The atresia was the result of this application.

Fig. 2.—*A*, shows incision in scar tissue; *B*, cervix uteri grasped with volsellum; *C*, cervix encircled by scar tissue.

The patient was sent to the hospital and under anesthesia the scar in the vault of the vagina was incised. Immediately about four ounces of dark blood escaped, evidently retained menstrual blood. The problem was how to prevent the recurrence of this atresia, and the thought came that if the cervix, after it was dug out of the adhesions, could be pulled down sufficiently so that normal mucous membrane could be sutured around it like a cuff, a subsequent atresia would be prevented. Accordingly the incision was enlarged and the cervix dug out of its adherent position and pulled through the incision in the scar of the vagina. The vaginal mucous membrane was then sutured to the cervix. The cervix was red and denuded of its mucous covering. The wound healed and the cervix became covered by an epithelial lining and the patient had one scanty menstruation. The drawings show the steps of the operation.

FORTY EAST FORTY-FIRST ST.

PROTEIN (MILK) INJECTIONS IN GYNECOLOGIC INFECTIONS*

By Reginald M. Rawls, M.D., F.A.C.S.
(Attending Surgeon)

DURING the last thirty years, the treatment of pelvic inflammatory disease in women has varied from a policy of immediate operation to "a watchful waiting" policy. However, in the literature of the past four or five years there have appeared, from time to time, articles advocating a return to the policy of immediate operation even in acute conditions. I believe I voice the sentiment of most American gynecologists in advocating a period of palliative treatment and operations only after the subsidence of the acute symptoms with no recurrence following a rather vigorous bimanual examination. Often pelvic inflammatory disease, especially gonococcal infection, clears up entirely under palliative treatment but with a mixed infection it is too often necessary to supplement this by a mutilating operation. Any aid to palliative treatment of pelvic inflammatory disease will be welcomed by all and such a measure I offer in the intramuscular injection of sterile cow's milk. It is no cure-all but fulfills almost, if not all, of the requirements of the ideal palliative treatment—in lessening the amount of acute suffering, lessening the number of mutilating operations, and when operation becomes necessary gives the patient an increased immunity to withstand the shock of or make possible more conservative operations.

It is impossible, in this article, to review the history, the general and focal reactions of protein therapy and their assumed biologic origin, but to those interested I would recommend the excellent little book of William F. Peterson[1] entitled "Protein Therapy and Nonspecific Resistance" published in 1922. From a review of this book we find during and following the period of specificity in therapeusis as inaugurated by Pasteur and Koch, and through the time of Von Behring, Ehrlich and Bordet, certain clinical observations which were the forerunners of what is now known as nonspecific resistance.

Wright mentions several such instances: "I confess to having shared the conviction that immunization is always strictly specific. Twenty years ago, when it was alleged before the Indian Plague Commission, that antiplague inoculation had cured eczema, gonorrhea, and other miscellaneous infections, I thought the matter undeserving of examination. I took the same view when it was reported in connection with antityphoid inoculation that it rendered the patients much less sus-

*Read at the Gynecological and Obstetrical Section of the New York State Medical Society Meeting, May, 1925.

ceptible to malaria. Again, seven years ago, when applying antipneumococcus inoculation as a preventive against pneumonia in the Transvaal mines, I nourished exactly the same prejudices. But here the statistical results which were obtained in the Premier Mine demonstrated that the pneumococcus inoculation had, in addition to bringing down the mortality from pneumonia by 85 per cent, reduced also the mortality from other diseases by 50 per cent. From then on, we had to take up into our categories the fact that inoculation produces, in addition to direct, also collateral immunization."

Peterson says "our recognition of nonspecific therapy really had its inception with the papers of Renaud, Kraus and Ichikawa: Renaud pointed out the value of heterobacteriotherapy; Kraus definitely settled this point when he reported favorable results in puerperal infection treated with colon vaccine and with this as a basis began the treatment of scarlet fever, plague, and septicemia. Ichikawa, independently, observed that when he treated paratyphoid cases with intravenous injections of typhoid vaccine, he obtained equally as good results as when it was used in typhoid cases."

From heterobacteriotheraphy it was but a logical step to attempt intravenous injections of bacterial components and bacterial split products; then, to protein split products of nonbacterial origin and finally, to the realization that any substance which was capable of inducing the shock reaction on the part of the patient would result in the same therapeutic change. Soon a number of agents were used and, in 1916, Schmidt and Saxl introduced intramuscular injections of milk to induce a protein reaction, i.e., the typical rise in temperature observed following other agents.

There are many theories and much research available to explain the protein reaction but quoting Gellhorn[2] who was the first to call attention, in this country, to the value of milk injections in gynecologic diseases, "* * * protein substances, introduced parenterally that is by subcutaneous, intramuscular, or intravenous injection, have the faculty of stimulating the cells to greater activity—of activating the protoplasm. All cells of the body feel this rejuvenating influence but none more so than those cells which have been weakened or paralyzed by infection."

Quoting Peterson "Protein therapy offers a potent, perhaps the most potent, method that we have at our command of altering the current of cellular activity in two diametrically opposite directions—acceleration of function and depression of function. If the agent that we inject is very toxic and the dose large, acceleration soon gives place to fatigue, to complete exhaustion and finally to death; if relatively large doses are repeatedly given the condition of protein cachexia, observed in experimental animals, might supervene. Proper dosage, on the other hand, results in transient but well marked stimulation without clinical ap-

parent fatigue, and if continued for a period of time the alteration of acceleration and depression of metabolic processes becomes manifest in increased weight and general well being." Further he says, "* * * * if we fix very firmly the concept that nonspecific therapy is purely a method of stimulation whereby all forces of cellular and humoral resistance are for a short period of time keyed to the highest pitch and by reason thereof, stimulation of this character is useless when the cells of the body are profoundly fatigued." Where a moderate reaction is desired Peterson advises the use of milk and if less general, but some focal effect is desired, Uddgren believes that milk with a low bacterial count is to be preferred.

Peterson calls attention to the fact that the nonspecific reaction is a "diphasic reaction—the first effect being the intensification of the disease manifestation both generally and locally, the second being a constructive phase in which there occurs a general euphoria, a diminution of disease symptoms both generally and locally, with, at times, complete restitution to the normal. Generally speaking, he says, it has been found that the more severe the first phase the greater the clinical benefit. Therapeutic results cannot be expected when the organism is no longer capable of response to stimulation. When complete fatigue has been reached no amount of stimulation will avail and the additional burden imposed by the material injected can only harm the patient."

Even with intramuscular injections of milk it is well to keep in mind the contraindications to the injections of the more active substances. Peterson says particular care must be observed to obtain a history of hypersensitiveness on the part of the patient—serum sickness, asthma, urticaria, angioneurotic edema or of epilepsy or other grave nervous instability. Alcoholism, pregnancy, various cardiac lesions and diabetes are also recognized as contraindications to the use of protein therapy, but neither old age nor infancy is so recognized by some observers.

Sensitization to repeated intramuscular injections of milk seems to be rare as few cases are reported, although it has been used rather extensively in Europe. This is thought to be due to the fact that the milk is boiled and so differentiated. Hecht made intracutaneous injections of milk into patients injected previously with milk and also into non-injected patients. There was no difference in the skin response, nor was he able to demonstrate milk antibodies.

Two years ago, following a conversation with Gellhorn, I began the use of milk injections in pelvic inflammatory conditions at the Woman's Hospital and have used it in 111 ward cases. The milk has been used intragluteally with an initial dose of 5 c.c. and then 10 c.c. every third or fourth day. In ambulatory cases in the out-patient department intradermal milk in 1 c.c. doses is used. These cases are not analyzed in this series but in one or two house cases with

intradermal injections the results compare favorably with the intramuscular method. I have used as many as twenty consecutive doses in a single case, but most often from six to eight injections, from which I believe we obtain the maximum of benefit, although occasionally a few more injections seem to be necessary.

We use Grade A whole milk and sterilize it in a water-bath for one hour at 60° C. or in the autoclave at 15 pounds pressure for fifteen minutes. The bottles and corks are boiled for thirty minutes and sterile precautions are used in filling the containers. The sterile milk, in its container, is kept in the ice box until used.

The technic of injection is to prepare the skin with tincture of iodine or alcohol and to introduce a sharp hypodermic needle, about one and a half inches in length, well into the gluteal muscles. If no blood escapes from the needle or is obtained by suction of the syringe, then we are sure that a blood vessel has not been entered and we shall avoid a severe protein reaction, provided the needle is not displaced later when attaching the barrel of the syringe. I feel sure that in 4 per cent of my series this precaution was not taken, for in this number there was more or less respiratory embarrassment, syncope, sharp pain referred to the back, abdomen or legs, with rather marked erythema and in one case a petechial eruption. Other precautions are to shake well the container so as to mix the cream and draw the fluid directly into the barrel of the syringe, rather than attempt to draw it through the small caliber of the needle. Further, to prevent the local initial pain, the fluid should be introduced rather slowly. In none of my series has it been necessary to resort to the use of novocaine, advocated by some writers.

Following the injection there is more or less local induration with pain for a few days, but never as troublesome as mercurial intramuscular injections, and in none of my series was there an abscess formation. Within a short time there is usually an increase in the subjective pain but marked relief within twenty-four hours after the first injection,—sometimes delayed until after the second injection. The sense of well being experienced by these cases is remarkable, especially as previous to protein therapy it was necessary to use repeated doses of codeine or even morphine in addition to all other known methods of palliative treatment.

This fact is so constant in adnexal inflammation that my associate, William T. Kennedy, suggested it as a differential sign in suspected ectopic gestation. The series so far is too small to draw definite conclusions, but in 3 out of 4 cases the failure of the injection to relieve pain was found to be due to ectopic gestation. In these few cases there was an early relief of pain but with a recurrence rather than a cessation as in salpingitis.

In the early injections there is usually a rise in temperature within

six or eight hours, from two to four degrees or more, over the usual afternoon rise, with a return in twenty-four hours to the preinjection level. This rise in temperature is accompanied by a corresponding rise in the pulse. This may continue in some cases throughout the time of treatment but usually there is no reaction after the third to sixth injection.

Accompanying this reaction there is an increase in the leucocytes from one to twenty thousand above the existing white count, or there may be, in the early injections, a leucopenia but usually with an increase of the polymorphoneuclear cells. In some cases these reactions may be delayed for forty-eight hours but usually it is earlier and has disappeared at this time.

In 10 per cent of my series there was a chilly sensation or a definite chill lasting as long as ten, twenty, or thirty minutes, but usually not as severe as that following typhoid injections. In an additional 9 per cent notes were made of a rather high temperature with sweating, headaches, restlessness, nausea and even vomiting.

When we compare, in Table I, the early or immediate results in 96 cases with the late or end-results in 78 cases, observed from one to twenty-one months after discharge from the hospital, we find the percentages almost identical. Further, in order to rule out cases with temporary pelvic congestion or hyperemia, we find in 52 cases with definite pelvic inflammatory masses, estimated to be from 3 to 12 cm. in size, a greater percentage of improvement than in either of the other divisions with a recovery in almost 31 per cent. Thus, I feel that my statistics are fairly accurate and would compare more favorably with other reported series had I a larger number of cases and had been able to treat more cases earlier in their infection for in my series but three cases gave bacterial evidence of gonorrheal infection. Bittman[3] reports 573 cases of pelvic inflammatory disease treated with milk injections with recovery in 76 per cent, improvement in 20 per cent and no improvement in 4 per cent.

TABLE I

COMPARISON OF EARLY AND END-RESULTS

	IMMEDIATE RESULTS (96 CASES) ON DISCHARGE FROM HOSPITAL		IMMEDIATE RESULTS (52 CASES) MASSES 3 TO 12 CM.		END-RESULTS (78 CASES) OBSERVED FROM 1 TO 21 MONTHS	
Recovery	37	38.5%	16	30.8%	30	38.5%
Improved	52	54.0%	34	65.4%	42	53.9%
Not Improved	7	7.5%	2	3.8%	6	7.6%

In a tabulation (Table II) of the degrees of pelvic inflammatory conditions in my series and the results of the milk injections we find that the results are better in those classified as chronic than in the subacute. This can be explained as many cases were diagnosed chronic from their

history while the condition was an acute exacerbation of an old pathologic condition or this pathology made them more susceptible to a fresh infection. This also emphasizes the clinical observation that acute conditions respond best to the milk injections.

TABLE II

DEGREES OF INFLAMMATION AND RESULTS OF TREATMENT

	IMMEDIATE RESULTS (96 CASES) ON DISCHARGE FROM HOSPITAL		END-RESULTS (78 CASES) OBSERVED 1 TO 21 MONTHS	
ACUTE	43		34	
Recovery	18	40.5%	14	41.0%
Improved	25	59.5%	20	58.8%
Not Improved	0	0.0%	0	0.0%
SUBACUTE	32		29	
Recovery	11	34.4%	10	34.5%
Improved	15	46.9%	14	48.0%
Not Improved	6	18.7%	5	17.0%
CHRONIC	21		15	
Recovery	8	38.1%	6	40.0%
Improved	12	57.1%	8	53.3%
Not Improved	1	4.8%	1	6.6%

TABLE III

SUMMARY OF END-RESULTS

	96 CASES (WHOLE SERIES)		52 CASES (MASSES 3 TO 12 CM.)	
No operation advised	75	78.2%	37	71.1%
Operations advised	21	21.8%	15	28.9%
Operations performed	17	17.7%	10	19.2%
*Hysterectomy	3	27.6%	3	20.0%
Conservative operations	14	82.4%	7	70.0%
Mortality (nonoperative)	2		2 in 78 cases	2.5%
Pregnancies			4 in 78 cases	5.1%

*One of the three hysterectomies done because of a fibroid uterus.

A summary of the end-results (Table III) shows operation was advised in from 22 to 29 per cent and actually performed in from 18 to 19 per cent without operative mortality and conservative operations possible in from 70 to 82 per cent. If we exclude one case of hysterectomy done because of marked fibroid involvement of the uterus there is a conservative operative percentage from 80 to 88.

Of the two deaths one was in a case of pelvic and abdominal tubercular peritonitis with extension to the bladder which at no time was suitable for operation and the other was a case which was improved by the milk injection and was reported to the follow-up clinic as having died but no information was obtained as to the cause of death.

In conclusion, it is of interest to note that there were four cases of subsequent pregnancy—two were delivered at term and two were progressing with their pregnancy when last seen in the follow-up clinic, one at six and one at three months. In three of the four infection was acquired postpuerperally and was not of gonorrheal origin which responds most

readily to any palliative treatment. Two were operated upon following the milk injections, one for the removal of an ovarian cyst which was unaffected by the injections and the other for the removal of a purulent tube. In one of these there was a "frozen or plaster of Paris" pelvis which had cleared up entirely with milk injections. Milk injections are especially applicable to cases of parametritis or exudate and since beginning the use of milk injections I have not done a posterior colpotomy. It may have so happened that no cases have presented with a fluctuating vaginal mass but have been those cases which were treated formerly by a waiting policy.

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RECONSTRUCTION OF THE URETHRA AFTER COMPLETE LOSS, COMPLICATING AN EXTENSIVE VESICOVAGINAL FISTULA

The Operative Technic Employed with Success*

By George Gray Ward, M.D., F.A.C.S.
(Chief Surgeon)

WHILE the difficulties to be overcome in the curing of extensive vesicovaginal fistulae are often appalling, yet it is surprising what patient persistence on the part of both patient and surgeon will accomplish in closing large defects in the bladder base. However, where there is added to these difficulties the complication of a destruction of the urethra and consequent loss of control, we have, indeed, a problem which will try our skill and ingenuity to the utmost. No two cases are exactly alike and the technic must frequently be improvised to meet the particular conditions present. Therefore, carefully executed illustrations, made during the operation, of the steps employed where success has been attained, must be of help to others in solving like problems. This, then, is my reason for reporting this case.

Mrs. M. I., age twenty-three, married two years, first came under my care at the Woman's Hospital in October, 1920, complaining of complete urinary incontinence dating from her labor in December, 1919, when she had a full-term baby delivered by craniotomy. During delivery the cervix was badly torn and a traumatic vesicovaginal fistula was produced. The patient entered the Lying-In Hospital in January, 1920, for the repair of the fistula, and I am indebted to Dr. Kosmak for the details of the history while in that institution as follows: "Exploration under anesthesia showed the fistula about one-half inch in diameter including the posterior portion of the urethra and involving the trigone. The vault of the vagina showed no opening communicating with the uterus and no trace of the cervix.

"The vaginal vault was very rigid, and full of scar tissue, and the bladder firmly anchored. It was impossible to separate the bladder wall from the uterus because of the inability to locate any cervical opening. Wide lateral incisions in the lower portion of the vagina failed to give sufficient room to expose the operative field thoroughly. An exploratory laparotomy was, therefore, done and disclosed a small, well-involuted uterus with normal tubes and ovaries. The lower segment of the uterus and the bladder were firmly embedded in a mass of scar tissue, so that the uterus could not be pulled upward. An incision was made transversely in the fundus and a sound carefully introduced in an attempt to find the outlet. This was accomplished with moderate pressure and a soft rubber catheter pushed through this artificial opening in the vaginal vault, and left *in situ*. The fundus uteri was closed with interrupted gut sutures, and no further at-

*Read before the American Gynecological Society, Hot Springs, Virginia, May 21-23, 1923.

Reprinted from *Surgery, Gynecology and Obstetrics*, November, 1923, pp. 678-682.

tempt to close the fistula was made. In May, 1920, on reexamination, the uterus was found anteverted, not freely movable, apparently sightly enlarged. The patient had had a menstrual flow lasting twenty-four hours two weeks previously. The fistula seemed reduced in size.''

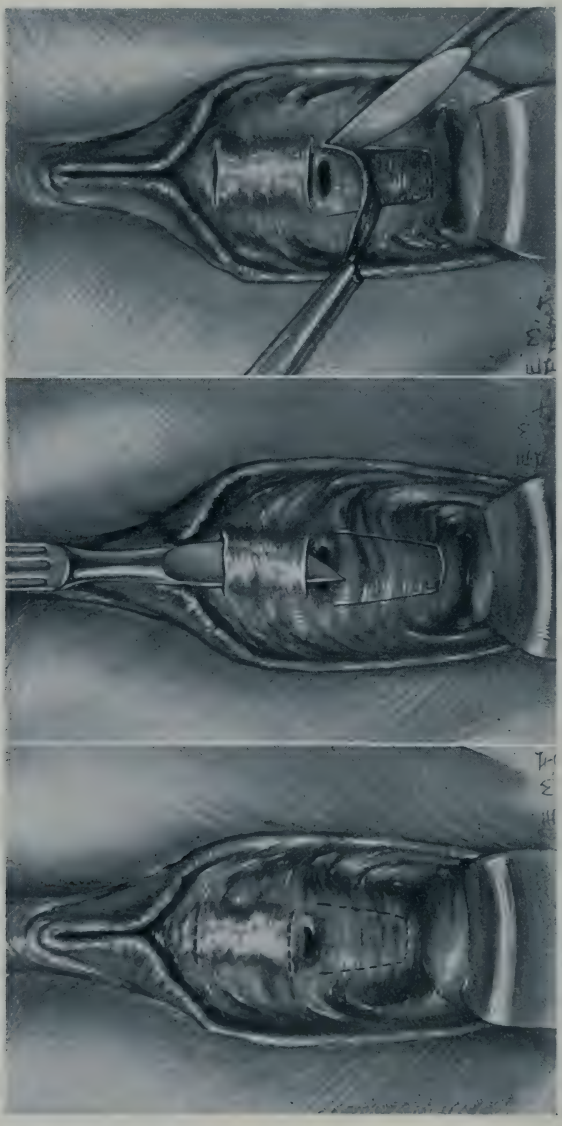


Fig. 1. Fig. 2. Fig. 3.

Fig. 1.—Reconstruction of the urethra. The condition of the parts shown after the operations for closure of extensive vesicovaginal fistula which involved loss of the anterior vaginal wall and trigone of the bladder the size of a twenty-five cent piece. The opening shown is at the site of the internal meatus. The white area above it represents the superior wall of the urethra, the posterior and lateral walls having been destroyed. Outline of the flap and incision.

Fig. 2.—Tunnel made with a scalpel in the vestibule behind the site of the urethra.

Fig. 3.—Dissecting up the flap for the new urethra which is left attached to the opening in the bladder.

Evidently the stenosis of the uterine canal had been relieved by this operation as the patient gave us a history of regular menstruation without discomfort since that time. Unfortunately, our difficulties were increased on account of the patient being very short and very obese, weighing over 200 pounds, but this was partially compensated for by her extraordinary happy disposition and common sense, and throughout she gave us every cooperation which, in no small measure, contributed to the success of our efforts.

Fig. 4.

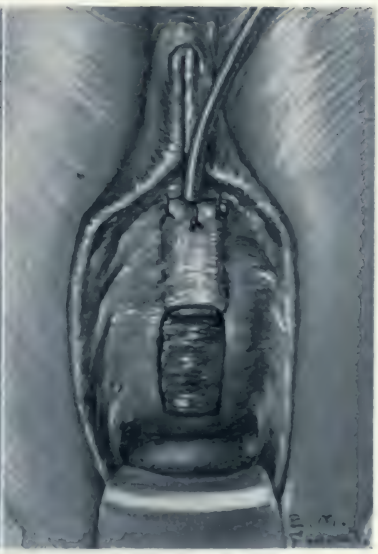


Fig. 5.

Fig. 4.—Drawing the flap through the tunnel to form the new urethra.

Fig. 5.—The flap sutures to the upper opening of the tunnel and a small catheter inserted into the bladder to maintain the patency of the new urethra.

Fig. 6.—The denuded area of the anterior vaginal wall is extremely thin as the flap was procured from the scar tissue of the previous operation for closure of the defect; therefore it requires reinforcement. The right labium minus is put on the stretch and an incision made throughout its length on its inner surface opening its folds.

Our examination showed a vesicovaginal fistula at the site of the trigone and involving the urethra, nearly as large as a 25 cent piece. There was dense scar tissue in the vaginal vault and on both sides of the pubic arch, making the base of the bladder and the anterior vagina and cervix firmly fixed. The posterior vagina also was full of scar tissue, the result of the previous operation.

On October 26, 1920, I operated as follows: A typical Schuchardt incision was made extending from the vault of the vagina to the coccyx. This gave an access without which it would scarcely have been possible to reach the parts involved (1). Incisions were then made through the scar tissue of the vaginal vault to the sub-pubic arch, and above, and on either side of the site of the urethra, thus loosening the tissues

Fig. 7.—The dissection unfolding the labium minus complete, and the first suture passed.

in order to allow approximation of the margins of the fistula without tension. The vaginal edges of the fistula were dissected free from the bladder edges for approximately one-quarter to one-half an inch and the bladder opening united with interrupted No. 1 tanned gut sutures. Silkworm-gut sutures closed the vaginal edges, and the incisions in the scar tissue were closed in the reverse direction with catgut. On the left side of the vaginal vault, it was impossible to close the incision in the scar tissue because of the tension, and it was left to granulate. A self-retaining catheter was inserted, and the Schuchardt incision was closed. No attempt was made to construct a urethra.

On November 23, 1920, the patient was again anesthetized and carefully examined. It was found that the fistula was now reduced to a diameter of about

one-quarter inch and was just posterior to the site of the internal meatus. The margins of this opening were denuded and interrupted sutures were passed to narrow the orifice in the hope of increasing the vesical control. The result of the operation was partially satisfactory, as the patient could remain dry while in the recumbent posture until the bladder became sufficiently filled to reach the level of the orifice at the neck of the bladder. By getting up to empty her bladder two or three times at night she was able to keep dry and she felt that a great gain over her previous distressing state had been accomplished. As soon as she stood erect, however, the leakage began to be troublesome. She was anxious for a further attempt to give her better control and she was readmitted to the hospital and the next operation was done on January 9, 1922, when an effort was made to construct a urethra.

Fig. 8.—Completing the suturing of this attached flap to the defect at the bladder base.

The inferior urethral wall was entirely absent, although the superior wall with its mucosa was present with fragmentary margins along each lateral wall. There was an entire absence of urethra or mucosa around the neck of the bladder at the site of the internal meatus. A scalpel was used to undermine the edges of each lateral wall of the superior urethra that remained, and the loosened flaps thus obtained were made to encircle a small rubber catheter which was passed into the opening in the bladder, and the edges were united with tanned gut sutures. The cut edges of the mucous membrane of the vestibule and anterior vaginal wall were then brought together over the new urethra with silkworm-gut sutures. The result of this operation was a complete failure as the tissues sloughed away, and the patient was discharged in the same condition as on her second admission.

She was admitted to the hospital for the third time on October 25, 1922, and I operated on November 8, 1922, and the result was most satisfactory.

In the first attempt I was guided by the method successfully employed by C. P. Noble,[2] and in studying the problem at the second operation

I determined to try the technic of Kelly, of making a tunnel under the vestibule and drawing through it a long flap, dissected from the anterior vaginal wall with its end left attached to the vesical opening.[3] I had grave doubts as to my being able to employ this ingenious procedure, because the anterior vaginal tissues from which I should have to obtain this flap were so thin, and were made up largely of scar tissue as a result of my original operation for the closure of the extensive defect in the trigone of the bladder. My fears were justified, as after I had succeeded in dissecting up a flap sufficient for my purpose, I had exposed the bladder wall underneath which was so extremely thin that it was not possible to leave it to granulate, and neither was it possible to ap-

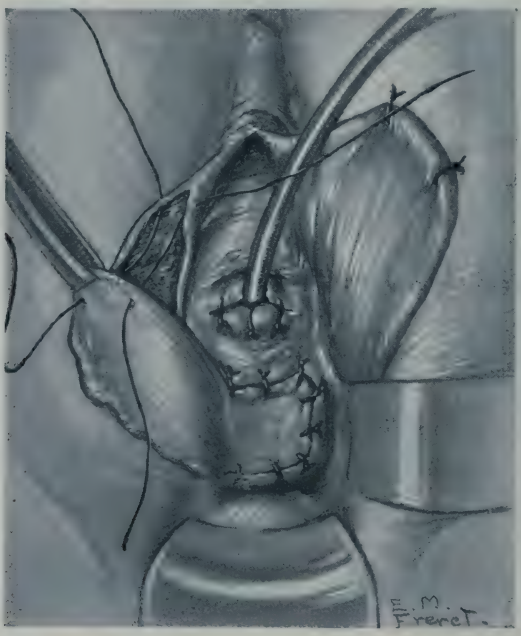


Fig. 9.—The denuded area of the vagina and the bladder completely closed with the attached flap and sutures passed to close the upper angle of the incision.

proximate the lateral edges of the vaginal wound as the denuded surface was too wide.

The suggestion of Noble to use the labium minus as an attached flap in this region seemed worth trying and I, therefore, resolved to employ this tissue to cover this denuded and weakened area at the base of the bladder. After first making a tunnel with a scalpel behind the original site of the urethra and drawing the vaginal flap through it and suturing it in place, I accordingly incised the inner surface of the right labium minus at its attachment to the vestibule from the region of the clitoris to its base and then unfolded it by careful dissection. This gave me an ample flap attached by a broad base which was easily brought in place over the denuded area of the vaginal wall and was sutured in position

with silkworm gut. The upper angle of the incision where the labia was detached was then sutured together. A very small soft rubber catheter (not a mushroom) was inserted in the new urethra and fastened with a suture.

The tissues healed without difficulty and the result was most satisfactory as the patient is dry in both the recumbent and erect posture and she can urinate without difficulty. We were particularly fortunate in establishing a good control in this case, probably due to some reenforcing sutures placed at the neck of the bladder at its junction with the new urethra.

Fig. 10.—The completed operation.

Complete loss of the urethra is of comparative rare occurrence and there are not many cases in the literature. Noble states that he has heard Emmet say that in his large experience while he had succeeded in six or seven cases in restoring the urethra all of them were unsatisfactory and he would abandon further attempts. In both Noble's and Kelly's cases, pressure with a tampon or special pessary was necessary to insure control. Baker Brown seems to have had unusual success in three cases he has reported.[4]

REFERENCES

[1]Ward: Surg., Gynec. and Obst., 1917, xxv, 126.
[2]Noble, C. P.: Am. Jour. Obst., 1901, xliii, 170.
[3]Kelly and Noble: Gynecological and Abdominal Surgery, i, 501.
[4]Brown, Baker: Brit. Med. Jour., 1863, 390.

A SUGGESTION FOR THE TECHNIC OF RECONSTRUCTION OF THE URETHRA AFTER COMPLETE LOSS*

By Lilian K. P. Farrar, A.B., M.D., F.A.C.S.
(Junior Attending Surgeon)

AS an after-thought following Dr. Ward's operation for reconstruction of the urethra after complete loss, the technic of which he has presented, it occurred to me that the defect in mucous membrane, lining

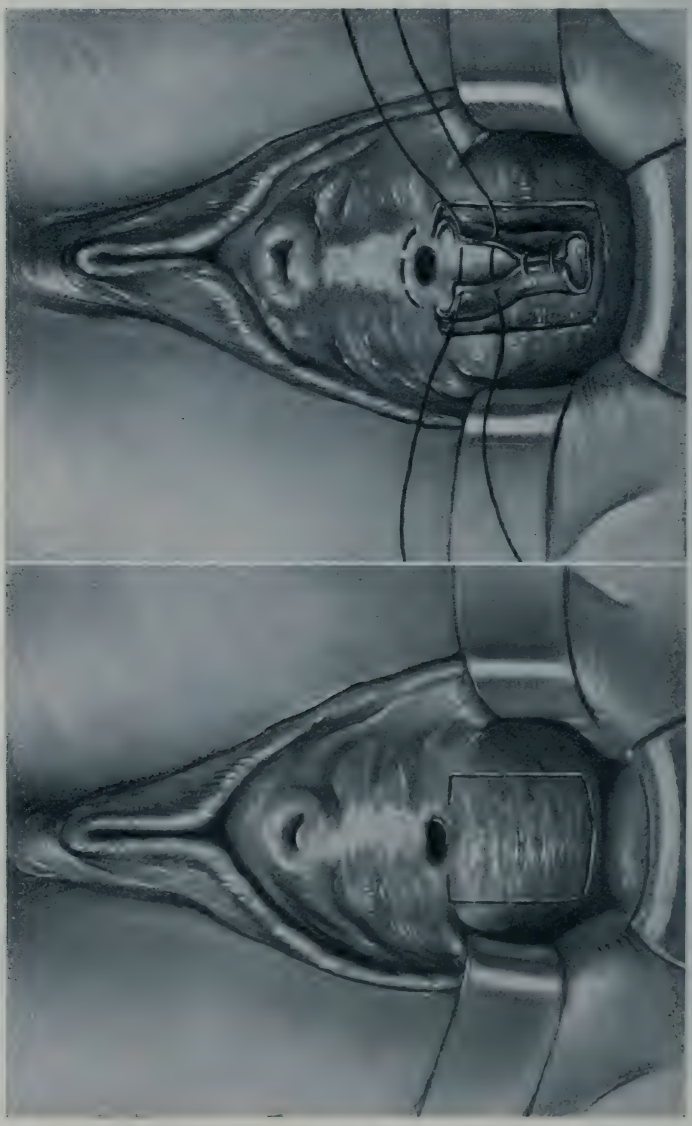


Fig. 2.

Fig. 1.

Fig. 1.—Outline of flap to be at the same location as in the Ward operation but wider.
Fig. 2.—Lateral edges of the flap united by sutures.

*Presented at the discussion of Dr. Ward's paper at the American Gynecological Society, Hot Springs, Va., May 21, 1923.

Reprinted from *Surgery, Gynecology and Obstetrics*, November, 1923.

the posterior surface of the tunnel which he made, might be obviated if a broader, rectangular flap were made to permit of the formation of a complete canal, by approximating the lateral margins of the flap. This tube would then be drawn through the tunnel made to receive it,

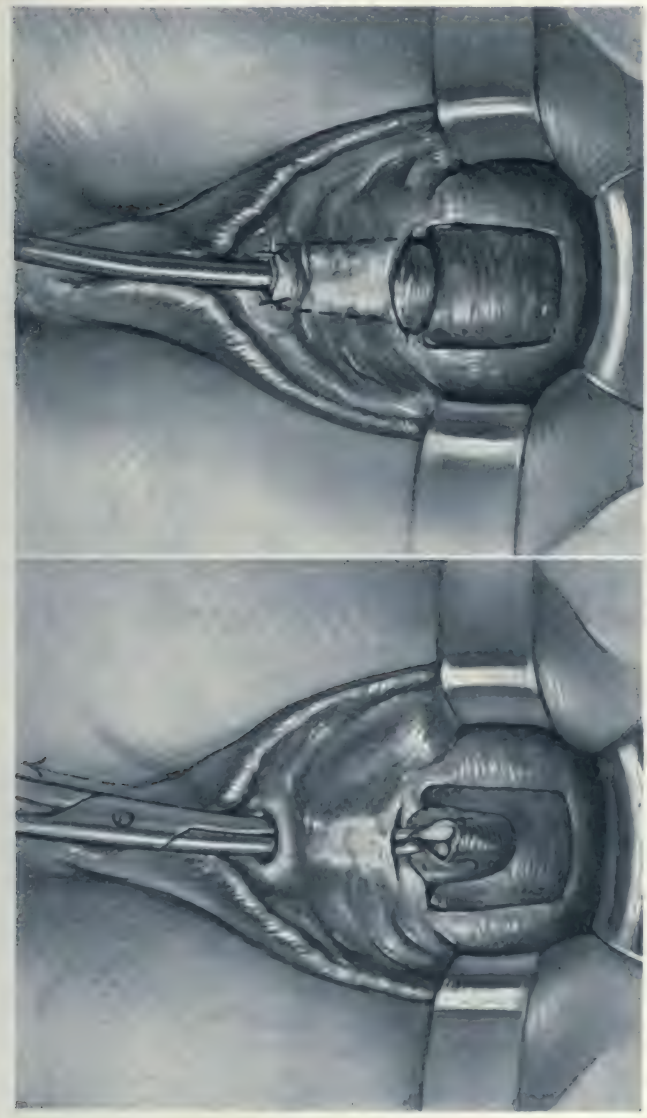


Fig. 4.

Fig. 3.

Fig. 3.—Flap pulled through tunnel.
Fig. 4.—Tube inserted to the upper opening of tunnel.

and the operation completed as in the original technic. A urethral canal lined throughout with mucous membrane should give a more perfect result than would be the case where but one-half of the canal was covered with mucous membrane, as in the original operation.

The four illustrations are self-explanatory.

AN ANALYSIS OF WOUND UNION IN 3,000 ABDOMINAL INCISIONS BASED ON THE WOMAN'S HOSPITAL CLASSIFICATION OF WOUNDS AND WOUND UNION

By Byron H. Goff, M.D., F.A.C.S.
(Junior Attending Surgeon)

THE abdominal incision, though a very simple operation, has been ranked among the most important procedures in abdominal surgery by Sir Berkley Moynihan, who has said: "I do not think that, though much has thereon been written, it is yet adequately recognized that the steps in the making and in the repair of an abdominal wound are of the very greatest importance. I doubt whether it is any exaggeration to say that the circumstances connected with the incision are among the most important in the whole range of abdominal surgery. For, if the incision be improperly made, by the free division of muscular fibres or the willful and unnecessary severing of nerve trunks, a weakened area is left in the belly wall, the result of which may be of even greater severity than those conditions which first made the operation advisable. Too great care cannot, therefore, be exercised in the proper choice of a method of incision and of the means of its securest closure." This authoritative opinion has encouraged me to submit for consideration the facts which have been established by an analysis of the wound records in 3,000 cases operated upon by the members of the Attending and Junior Attending Staffs of the Woman's Hospital.

In discussing the subject of wound union in the abdominal incision from a technical viewpoint, it is important to keep clearly in mind that the methods now employed in this procedure have been practically standardized, and, furthermore, that the vast majority of surgeons are satisfied with the results which follow the employment of such methods. It is equally important, however, not to be forgetful of the fact that some form of faulty wound union occurs in a very considerable percentage of clean as well as in contaminated wounds, made and closed by standard methods, and where rigid standards are applied it constitutes the most frequent and at the same time one of the most troublesome and time-consuming postoperative complications in abdominal surgery. The exact incidence of this complication has not been definitely determined because of a lack of standard classifications and adequate studies of sufficiently large series of cases.

The objects of the present study have been:

1. To establish a classification of abdominal incisions dependent upon the conditions present at the time of operation.

2. To establish a logical classification of wound union in such incisions.
3. To learn the actual incidence of faulty union in both clean and contaminated incisions.
4. To determine the maximum allowable incidence of faulty union in abdominal incisions.
5. To compare the immediate results following the different methods employed, especially in the closure of the wound.

Conditions at the Woman's Hospital have been remarkably favorable for such a study because of the fact that all members of the staff operate upon very similar classes of cases under practically identical conditions. In each case studied the preoperative preparation, the protection of the wound at the time of operation the materials used in the closure of the wound and the postoperative care of the case have been the same. Furthermore, there has been in operation for the past four and a half years a definite method of recording wound union in all forms of incised wounds. It is to be noted, however, that despite the similarity of conditions under which the members of the staff work no effort has been made to compare the results of one surgeon with those of another because of the differences in operative skill, the amount of trauma inflicted upon the tissues and other variations in technic, all of which factors obviously make such a comparison impossible. The only comparison, which can be safely made, is one in which the results of each individual surgeon working with but a single variable factor—the character of suture material—in two different groups of cases are compared.

METHOD OF RECORDING WOUND UNION

Early in 1919, Dr. George Gray Ward became interested in the subject of faulty wound union because of the morbidity and the costly loss of time to the convalescent patient, to the hospital, and to the prospective ward patient for which it is responsible, and instituted as a part of the hospital standardization program at the Woman's Hospital, a method of recording the facts pertaining to the making, the closure, and the union of all incised wounds of the abdominal wall, the mammary and lumbar regions, and the vagina. A Wound Record Form (Fig. 1) was made a part of every case record so that all data concerning the wound might be recorded on one form in the record, and a simple, yet efficient card index system was established, by means of which all facts concerning wound union may be tabulated. Only through the aid of this system has it been possible for me to review a rather large amount of statistical material.

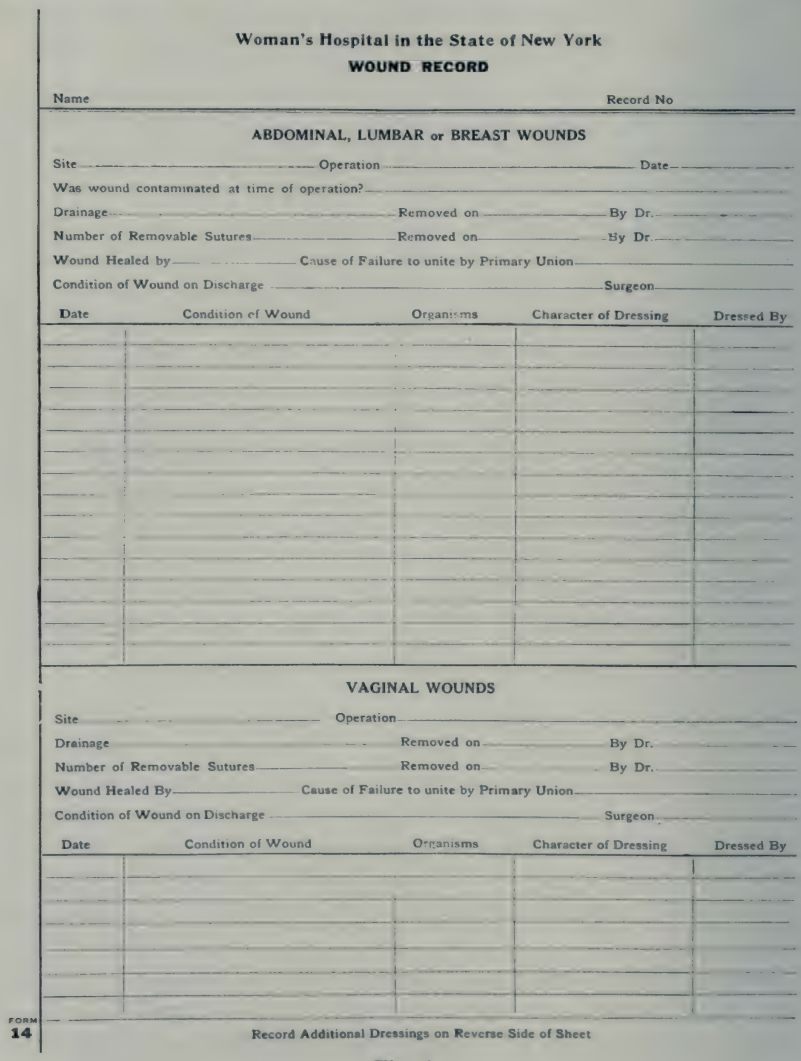
CLASSIFICATION OF ABDOMINAL INCISIONS

Before entering upon a study of wound union in abdominal incisions it was essential that they be classified according to the conditions present

at the time of operation. All abdominal incisions included in this review have, therefore, been divided into two classes as follows:

CLASS I—*Wound Clean at the Time of Operation.*

In Class I are placed wounds which have not been exposed to infectious or suspiciously infectious material during operation.



Woman's Hospital in the State of New York

WOUND RECORD

Name _____ Record No _____

ABDOMINAL, LUMBAR or BREAST WOUNDS

Site _____ Operation _____ Date _____

Was wound contaminated at time of operation? _____

Drainage _____ Removed on _____ By Dr. _____

Number of Removable Sutures _____ Removed on _____ By Dr. _____

Wound Healed by _____ Cause of Failure to unite by Primary Union _____

Condition of Wound on Discharge _____ Surgeon _____

Date	Condition of Wound	Organisms	Character of Dressing	Dressed By

VAGINAL WOUNDS

Site _____ Operation _____

Drainage _____ Removed on _____ By Dr. _____

Number of Removable Sutures _____ Removed on _____ By Dr. _____

Wound Healed By _____ Cause of Failure to unite by Primary Union _____

Condition of Wound on Discharge _____ Surgeon _____

Date	Condition of Wound	Organisms	Character of Dressing	Dressed By

FORM 14

Record Additional Dressings on Reverse Side of Sheet

Fig. 1.

CLASS II—*Wounds Contaminated at the Time of Operation.*

In Class II are placed wounds which have been exposed to purulent material, to material from sloughing or gangrenous masses of any sort, to the contents of the urinary organs and to the contents of the gastro-intestinal tract, excepting cases in which operations on the interval ap-

pendix or gall bladder have been performed without drainage. Wounds through which operations have been performed for acute inflammatory disease are considered contaminated, as are all wounds through which intra-abdominal or pelvic drainage has been established. On the contrary, wounds through which deliberate or accidental entrance into the vagina has been made are classified as clean wounds.

CLASSIFICATION OF WOUND UNION

The following classification of wound union, which takes into consideration not only infection as a cause of faulty wound union, but all other causes as well, has been developed and adopted as the standard classification for the Woman's Hospital:

CLASS A.

WOUNDS WHICH UNITE BY PRIMARY UNION:

Any break in the union of a wound excludes it from Class A.

Any discharge of blood, serum or fatty material which occurs after the tenth day excludes a wound from Class A.

CLASS B.

WOUNDS WHICH DO NOT UNITE BY PRIMARY UNION BECAUSE OF MINOR DEFECTS SUCH AS:

1. Slight infection.
2. Slight degree of fat necrosis.
3. Small hematoma.
4. Slight stitch-hole infection which involves the line of union of the wound.
5. Collection of serum discharged after the tenth day.
6. Slight separation of the tissues.
7. Slight degree of pressure necrosis.
8. Cigarette or tube drain following the removal of which the wound heals promptly by granulation without infection.
9. Cigarette or tube drain plus slight infection about the drainage tract.
10. Foreign body (unabsorbed suture material, etc.) following the removal of which the wound heals promptly by granulation with or without slight infection.

No case which has been detained in the hospital one or more days because of the condition of the wound is to be placed in Class B.

CLASS C.

WOUNDS WHICH DO NOT UNITE BY PRIMARY UNION BECAUSE OF MAJOR DEFECTS SUCH AS:

1. Extensive infection.
2. Marked degree of fat necrosis.
3. Large hematoma.
4. Extensive stitch-hole infection which involves the line of union of the wound.
5. Wide separation of the tissues, with or without partial evisceration, which results in prolonged healing by granulation with or without infection.
6. Marked degree of pressure necrosis.
7. Cigarette or tube drain, following the removal of which the drainage tract heals by prolonged granulation without infection.
8. Cigarette or tube drain plus extensive infection about the drainage tract.

9. Foreign body (unabsorbed suture material, etc.) causing a sinus along which there is prolonged granulation or infection.
10. Intestinoabdominal or vesicoabdominal fistula.

All cases which have been detained in the hospital one or more days because of the condition of the wound are to be placed in Class C.

Small rubber tissue or silkworm-gut drains placed in fat of the abdominal wall are not to be considered causes of faulty union.

MATERIAL STUDIED

The present analysis covers 3,000 abdominal incisions made and closed by nine members of the Attending and Junior Attending Staffs of the Woman's Hospital over a period of approximately three and a half years. Of the 3,000 incisions, 2,755 have been classified as clean, while 245 incisions have been classified as contaminated at the time of operation. The procedures performed through these incisions have been largely gynecologic with an occasional operation on the appendix or gall bladder, or for some type of hernia. Mammary and kidney incisions have been excluded. The vast majority of incisions have been longitudinal median ones, the remainder have been transverse, suprapubic, paramedian, McBurney or inguinal. With the exception of a very small number, the incisions have been of the intermuscular type rather than the type in which muscle fibers are separated.

PREOPERATIVE PREPARATION OF ABDOMEN AND PROTECTION OF WOUND AT THE TIME OF OPERATION

Approximately twelve hours before operation the abdominal skin from ensiform to pubes is washed with tincture of green soap and water which are applied with gauze. Following the removal of the soap by means of sterile water, the skin is washed with alcohol followed by ether which is allowed to evaporate before a dressing of sterile gauze is applied. Not less than two hours and not more than four hours before operation the skin is painted with 3.5 per cent tincture of iodine and covered with fresh sterile gauze. A second application of 3.5 per cent tincture of iodine is made on the abdominal skin a few moments before the abdomen is opened.

During the operative procedure all of the incised tissues from peritoneum to skin are protected by means of folded towels or gauze pads which are held in place by suitable clamps. The protection is not removed until the operator is prepared to close the skin incision.

METHODS OF CLOSURE OF INCISIONS

Two widely different methods of wound closure have been employed. In one, the abdominal wall has been closed in layers by catgut sutures of the best quality supplied by a prominent manufacturer, reenforced by removable tension sutures of silk or silk-worm gut; in the other, the closure has been accomplished by means of removable silk sutures in all layers excepting the peritoneum. The former method is one with which

all surgeons are familiar, while the latter method is unique and, therefore, requires a somewhat detailed description.

CLOSURE OF THE ABDOMINAL INCISION BY REMOVABLE SUTURES OF SILK

A number of years ago Dr. C. G. Child, of New York, conceived the idea that catgut, which must be converted into a soluble gelatin before absorption by the body tissues is possible, constituted an important predisposing cause of infection in the incised abdominal wound. He reasoned that this gelatinous material in the presence of body temperature, body tissues and fluids formed a favorable culture medium for the growth of pyogenic microorganisms which might be introduced at the time of operation, and that the absorption of catgut placed an unnecessary burden upon the tissues of the belly wall, especially on the areolar, fat filled and relatively avascular layer, which lies between the anterior sheath of the rectus muscle and the skin. He, furthermore, argued that catgut, because of its unreliability in sterility and tensile strength and the wide variations in the time necessary for its absorption in different individuals, was not a dependable suture material to employ in a structure such as the sheath of the rectus muscle, upon which the future integrity of the belly wall largely depends. Child, therefore, abandoned all absorbable suture material in the closure of the abdominal incision in all layers excepting the peritoneum, and attempted to close the wound by means of a continuous mattress suture of silkworm-gut, which was to have been removed on the twelfth or fourteenth postoperative day. This method proved a failure because of the difficulty of removing without breaking the suture. Silver wire in the form of a continuous mattress suture was next tried and, though not practical because of considerable difficulty in placement and removal, was responsible for very excellent results. The incidence of infection in wounds closed by this method was decidedly lower than in catgut-closed wounds. In 1915, there was placed upon the market, by a prominent manufacturer of suture material, a specially treated twisted silk tension suture of great tensile strength and pliability. This material was substituted for silver wire in the closure of incisions and has given practically ideal results. This last method has been used in the closure of 1,110 clean and 87 contaminated incisions in the series under consideration. In detail the method is as follows:

Placing the Sutures.—The peritoneum, transversalis fascia and posterior sheath of the rectus muscle are closed by a continuous suture of plain catgut.

The rectus muscle is not sutured.

The anterior sheath of the rectus muscle is closed by a continuous mattress suture of the prepared silk, both ends of which are carried through the fatty layer and skin to the surface on one side of the incision at the angles of the wound. (Suture 1.) (Fig. 2.)

The *deep layer of the superficial fascia* of the abdominal wall is closed by a continuous mattress suture of prepared silk, the ends of which are passed through the fatty tissue and emerge at the angle of the wound (Suture 2). (Fig. 3.)

The *skin* is closed by a subcuticular continuous suture of prepared silk, the ends of which are passed through the skin to the surface on the side

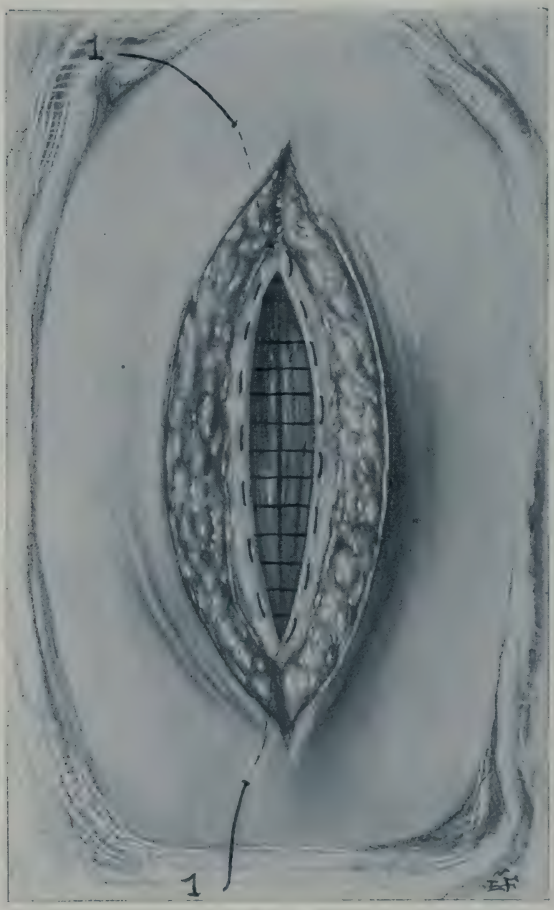


Fig. 2.

of the wound opposite that upon which the deepest suture emerged (Suture 3). (Fig. 4.)

When tightening the sutures it is important not to pull them backward and forward after they have been placed, but to allow them to remain stationary, as there is a certain cohesion between tissues and suture material which assures an ideal approximation until union is complete.

In tying the sutures, Suture No. 1 is tied by a bowknot to Suture No. 3 over a gauze bolster at the lower angle of the wound. The other ends

of the same sutures are tied together in a similar manner at the upper angle of the incision. The ends of Suture No. 2 should be at least three inches each in length and should not be tied.

Removal of Sutures.—On the tenth postoperative day the bowknot at the lower angle of the incision is untied and the bolster removed.

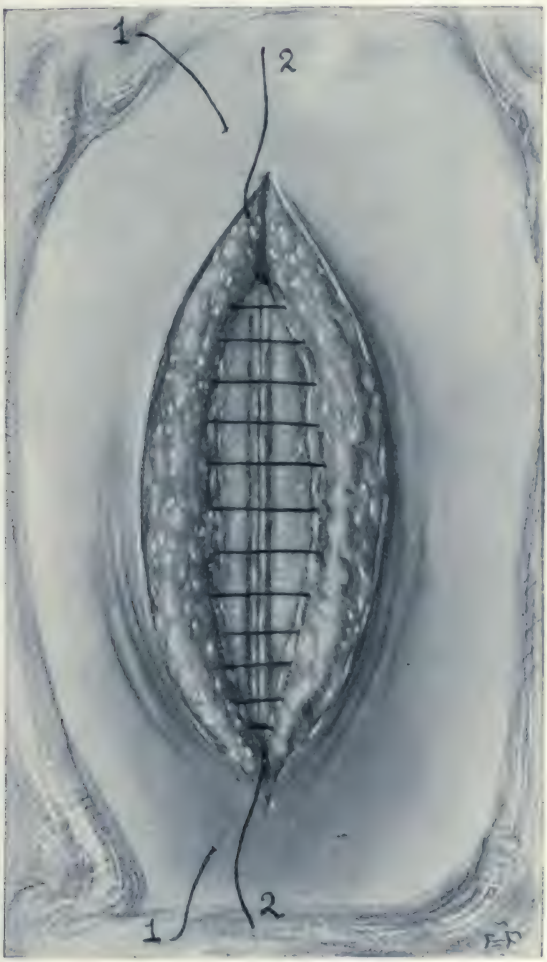


Fig. 3.

A small amount of tincture of iodine is allowed to run into the suture tracts, the sutures are iodinized near the skin and then cut beneath the surface of the skin. At this time the upper ends of the sutures are not disturbed. No attempt to remove any of them at this time is made. On the twelfth day the upper bowknot is untied and a gentle attempt made to withdraw all three sutures,—the skin suture (Suture No 3) first, the suture in the deep layer of the superficial fascia (Su-

ture No. 2) next and finally the suture in the anterior sheath of the rectus muscle (Suture No. 1).

If the removal of any of the sutures is found to be difficult, a small artery clamp is placed on the end of the suture to prevent retraction beneath the skin and wrapped in the dressing until a second attempt is

Fig. 4.

made the following day. The second or third attempt results in easy removal, if the sutures have been properly placed at the time of closure.

The advantages of this method of wound closure over the usual catgut method are:

1. A dependable suture material of great tensile strength is employed. The tensile strength of catgut is always questionable; after the tenth postoperative day it is negligible.

2. The suture material is thoroughly sterilizable without a reduction in its tensile strength. The sterility of catgut is always questionable.
3. The tissues—especially the fatty tissues—are not required to absorb a foreign body, such as catgut.
4. Ideal apposition without strangulation of the tissues until union is complete.

There is but a single objection to the method, and that not a serious one, namely, difficult removal if the suture has not been properly placed or if a premature attempt at removal is made. If perchance a part of a suture should be left permanently in the tissues through breakage at the time of removal, no harm has been done. In this connection it is important to bear in mind the fact that surgeons of wide experience bury silk sutures in the sheath of the rectus with no intention of removing them. In no case in the series studied has it been necessary to reopen the wound for the removal of a suture broken in removal.

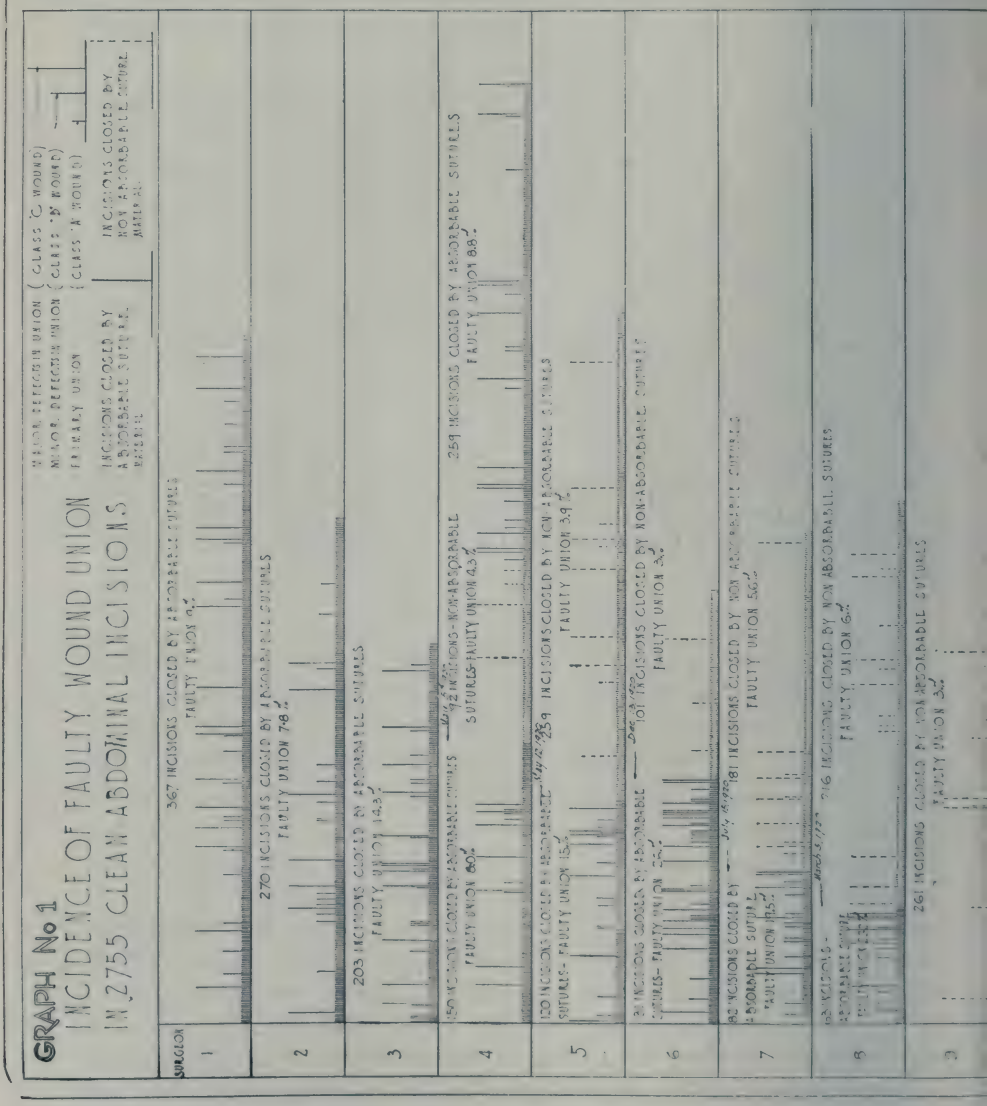
Of 2,755 incisions classified as clean, 1,645 have been closed by the conventional catgut method, while 1,110 have been closed by the removable silk suture method described above. Of 245 incisions classified as contaminated at the time of operation, 158 were closed by catgut and 87 closed by removable silk sutures. The results are shown in the following graphs.

ANALYSIS OF GRAPHS

Graph I shows the chronologic incidence of faulty wound union in 2,755 clean abdominal incisions. It brings out the fact that Surgeon 1 has closed 367 incisions by the conventional catgut method with a faulty union of 9 per cent. Surgeon 2, who has used a similar method in 270 cases has met with an incidence of faulty union of 7.8 per cent, while, in the work of Surgeon 3, who has also used a catgut closure in 220 incisions, there has been an incidence of faulty union of 14.3 per cent. The part of the graph which deals with the work of the next five surgeons—Surgeons 4, 5, 6, 7, and 8 is of special interest in that it shows a decided reduction in the incidence of faulty union upon the abandonment of catgut and the adoption of the removable silk suture method of closure. In the case of Surgeon 4 there has been a reduction of faulty union of approximately 100 per cent, while it has been greater in the work of Surgeons 5, 6, 7, and 8. It will be noted that the conversion from one type of closure to the other has occurred at a different time in each instance. Surgeon 9, who has employed only the removable silk suture method of closure in 261 incisions, has met with an incidence of faulty union of 3.0 per cent. This graph, brings out very clearly one very important point, namely, *that with all other factors remaining constant*, the adoption of the removable silk method of closure has, in the work of

all surgeons who have used both methods, invariably resulted in a very decided reduction in the incidence of faulty union in the abdominal wound.

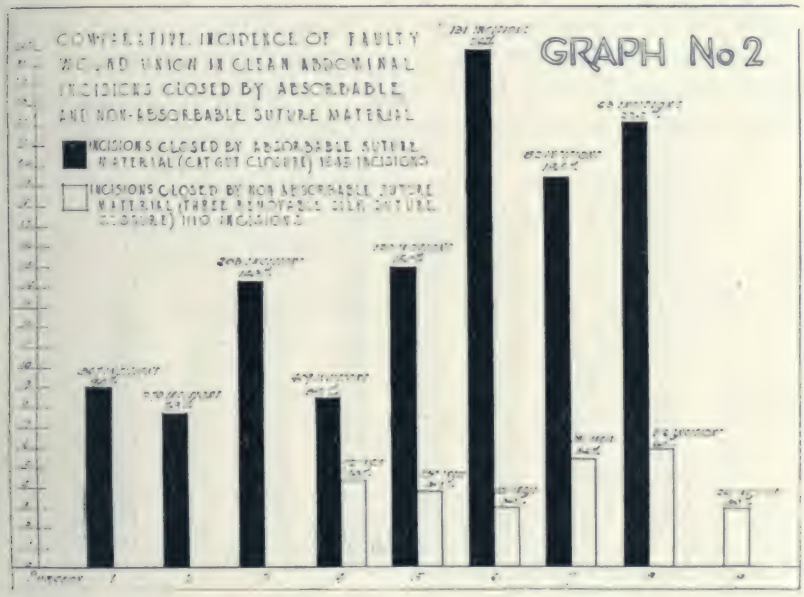
Graph II shows clearly the relative incidence of faulty union in clean


GRAPH No 1
INCIDENCE OF FAULTY WOUND UNION
IN 2755 CLEAN ABDOMINAL INCISIONS
MINOR DEFECTIVE UNION (CLASS 'C' WOUND)
MINOR DEFECTIVE UNION (CLASS 'B' WOUND)
PRIMARY UNION (CLASS 'A' WOUND)
INCISIONS CLOSED BY ABSORBABLE SUTURE MATERIAL
INCISIONS CLOSED BY NON ABSORBABLE SUTURE MATERIAL
SURGEON
1
367 INCISIONS CLOSED BY ABSORBABLE SUTURES
FAULTY UNION 9%
2
270 INCISIONS CLOSED BY ABSORBABLE SUTURES
FAULTY UNION 7.8%
3
203 INCISIONS CLOSED BY ABSORBABLE SUTURES
FAULTY UNION 14.3%
150 INCISIONS CLOSED BY ABSORBABLE SUTURES
FAULTY UNION 6%
4
SUTURES-FAULTY UNION 4.3%
259 INCISIONS CLOSED BY NON-ABSORBABLE SUTURES
FAULTY UNION 8.8%
5
150 INCISIONS CLOSED BY ABSORBABLE SUTURES-FAULTY UNION 15%
259 INCISIONS CLOSED BY NON ABSORBABLE SUTURES
FAULTY UNION 3.9%
6
81 INCISIONS CLOSED BY ABSORBABLE SUTURES-FAULTY UNION 25%
101 INCISIONS CLOSED BY NON-ABSORBABLE SUTURES
FAULTY UNION 3%
7
80 INCISIONS CLOSED BY ABSORBABLE SUTURES
FAULTY UNION 18.5%
181 INCISIONS CLOSED BY NON ABSORBABLE SUTURES
FAULTY UNION 5.6%
8
216 INCISIONS CLOSED BY NON ABSORBABLE SUTURES
FAULTY UNION 6%
3
261 INCISIONS CLOSED BY NON ABSORBABLE SUTURES
FAULTY UNION 3%

incisions closed by absorbable and nonabsorbable suture material. Special attention is called to the fact that the incidence of faulty union in incisions closed by the removable silk suture method has in every instance been lower than the lowest incidence in catgut closures.

Graph III shows the relative incidence of the *causes* of faulty union in

2,755 clean abdominal incisions. In practically every instance the incidence of defective union has been lower in the wounds closed by non-absorbable suture material. The one exception is found under the head-


GRAPH No 2
COMPARATIVE INCIDENCE OF FAULTY WOUND UNION IN CLEAN ABDOMINAL INCISIONS CLOSED BY ABSORBABLE AND NON-ABSORBABLE SUTURE MATERIAL
INCISIONS CLOSED BY ABSORBABLE SUTURE MATERIAL (CATGUT CLOSURE) 1648 INCISIONS
INCISIONS CLOSED BY NON ABSORBABLE SUTURE MATERIAL (THREE REMOVABLE SILK SUTURE CLOSURE) 1110 INCISIONS

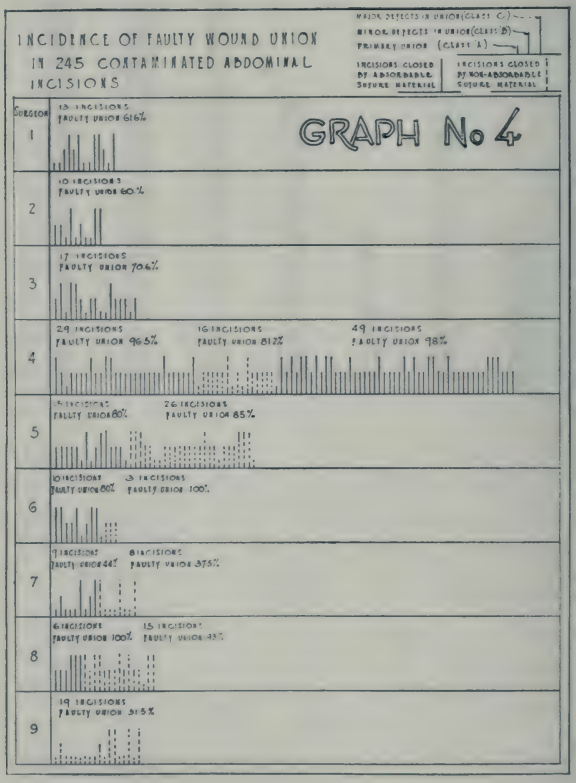
GRAPH No 3 RELATIVE INCIDENCE OF THE CAUSES OF FAULTY WOUND UNION IN 2755 CLEAN ABDOMINAL INCISIONS EXPRESSED IN PERCENTAGES

SURGEON	1	2	3	4	5	6	7	8	9	AVERAGE INCIDENCE
EXTENSIVE INFECTION (CLASS C)	4.1	2.2	4.9	1.1 4.4	2.7 4.2	1.0 0.9	2.8 6.3	3.2 9.5	1.1	2.1 4.7
SLIGHT INFECTION (CLASS B)	2.6	4.1	3.9	2.1 8.3	1.2 [illegible]	2.0 1.1	2.6 12.5	2.3 9.1	1.5	1.9 5.5
LARGE HEMATOMA (CLASS C)	0.5	0.4	0.5			0.4	1.2	0.5		0.1 0.3
SMALL HEMATOMA (CLASS B)	0.5	0.7	1.0	0.2		0.8		1.6		0.5
EXTENSIVE FAT NECROSIS (CLASS C)						0.8				0.06
SLIGHT FAT NECROSIS (CLASS B)	0.4	0.6	1.5			1.4				0.4
WIDE SEPARATION OF TISSUES (CLASS C)				1.1 0.2					0.4	0.2 0.06
SLIGHT SEPARATION OF TISSUES (CLASS B)			0.5	0.2						0.1
INFECTION OF SEAM (CLASS B)	0.2			0.2						0.2
FOREIGN BODY (CLASS B)	0.2									0.1
FECAL FISTULA (CLASS C)				0.2	0.2	0.2				0.1
TOTAL INDIVIDUAL INCIDENCE OF FAULTY WOUND UNION	7.0	7.8	11.9	4.3 8.9	3.9 8.0	3.0 2.3	5.6 12.5	6.0 20.2	3.0	TOTAL AVERAGE INCIDENCE OF FAULTY UNION 4.3 12.1

ing "Wide Separation of Tissues" in which case the figures are based on three accidents of this sort in the work of Surgeon 4 and one in the work of Surgeon 9. The graph shows clearly that the total average inci-

dence of faulty union in clean abdominal incisions from all causes has been 4.3 per cent in wounds closed by nonabsorbable suture material, while in wounds closed by absorbable sutures the total average incidence of faulty union has been 12.1 per cent.

Graph IV shows the chronologic incidence of faulty wound union in 245 contaminated abdominal incisions. Attention is called to the fact that the number of contaminated cases operated upon by each surgeon is small excepting in the case of Surgeon 4. The graph, therefore, is of

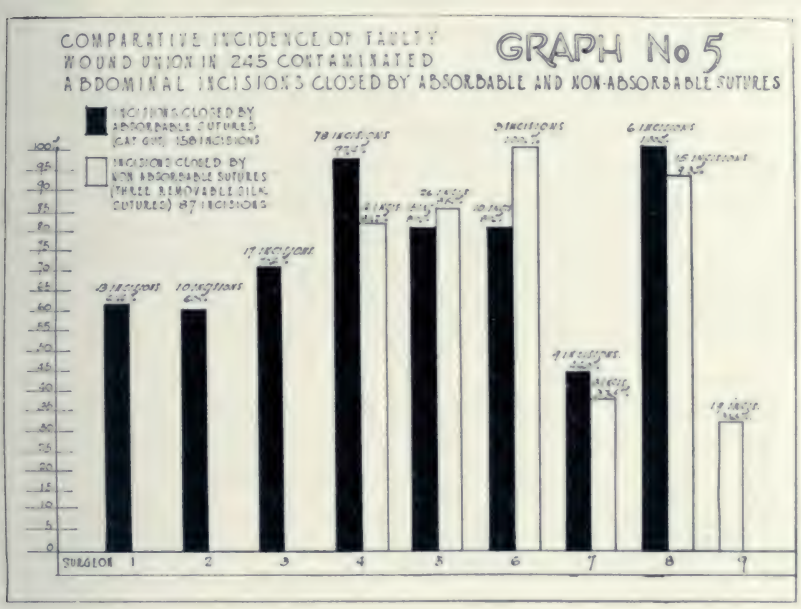


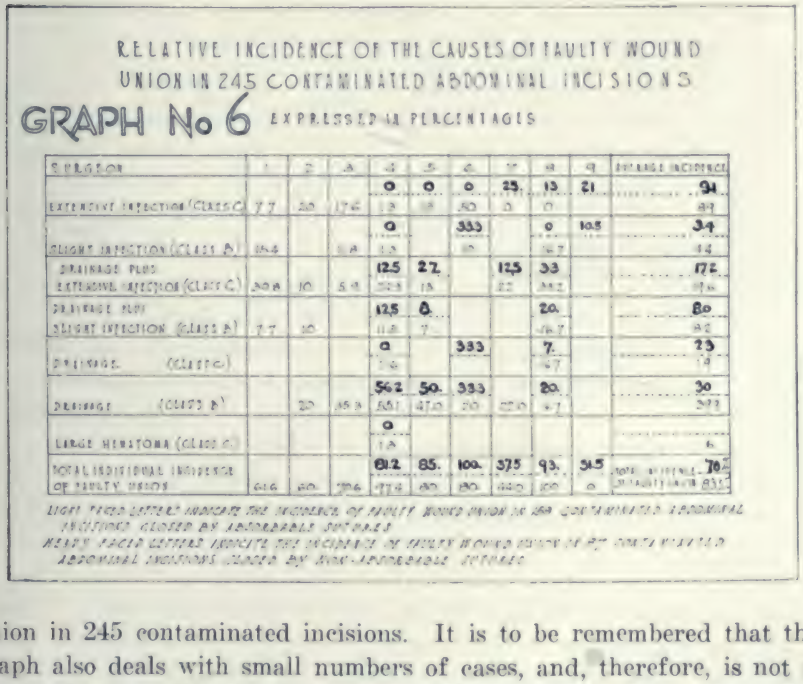
somewhat less value than if there had been larger numbers of cases from which to draw conclusions. Here, again, is shown the reduction in faulty union which accompanies the conversion from the use of absorbable to nonabsorbable suture material in the closure of abdominal incisions, excepting in the work of Surgeons 5 and 6, where the incidence of faulty union has been slightly higher in the case of wounds closed by nonabsorbable material. It is doubly difficult to draw conclusions when studying contaminated cases because of the wide variations in the nature of the contamination.

Graph V shows the relative incidence of faulty union in contaminated wounds closed by absorbable and nonabsorbable suture material. Here it

is also important to remember that the graph is based upon a small number of cases.

Graph VI shows the relative incidence of the various *causes* of faulty


COMPARATIVE INCIDENCE OF FAULTY WOUND UNION IN 245 CONTAMINATED ABDOMINAL INCISIONS CLOSED BY ABSORBABLE AND NON-ABSORBABLE SUTURES
GRAPH No 5
INCISIONS CLOSED BY ABSORBABLE SUTURES (CAT GUT) 158 INCISIONS
INCISIONS CLOSED BY NON ABSORBABLE SUTURES (THREE REMOVABLE SILK SUTURES) 87 INCISIONS
SURGEON 1 2 3 4 5 6 7 8 9


RELATIVE INCIDENCE OF THE CAUSES OF FAULTY WOUND UNION IN 245 CONTAMINATED ABDOMINAL INCISIONS
GRAPH No 6
EXPRESSED IN PERCENTAGES
SURGEON
EXTENSIVE INFECTION (CLASS C)
SLIGHT INFECTION (CLASS B)
DRAINAGE PLUS EXTENSIVE INFECTION (CLASS C)
DRAINAGE PLUS SLIGHT INFECTION (CLASS B)
DRAINAGE (CLASS C)
DRAINAGE (CLASS B)
LARGE HEMATOMA (CLASS C)
TOTAL INDIVIDUAL INCIDENCE OF FAULTY UNION
AVERAGE INCIDENCE
LIGHT FACED LETTERS INDICATE THE INCIDENCE OF FAULTY WOUND UNION IN 158 CONTAMINATED ABDOMINAL INCISIONS CLOSED BY ABSORBABLE SUTURES
HEAVY FACED LETTERS INDICATE THE INCIDENCE OF FAULTY WOUND UNION IN 87 CONTAMINATED ABDOMINAL INCISIONS CLOSED BY NON-ABSORBABLE SUTURES

union in 245 contaminated incisions. It is to be remembered that this graph also deals with small numbers of cases, and, therefore, is not of great value excepting for the averages which it shows. It is to be noticed

that the average incidence of the several causes of faulty union is always lower in incisions closed by nonabsorbable suture material than in those closed by catgut excepting under the heading "Major Infections" where the incidence is slightly higher than in the gut-closed wound. The graph finally shows that the total average incidence of faulty wound union in contaminated incisions from all causes including drainage, has been 70 per cent in wounds closed by nonabsorbable suture material against 83.5 per cent in wounds closed by catgut.

A perusal of Graphs III and VI shows that, though there are other important causes of faulty wound union, *infection is the principal cause.* Since this is true, and since surgeons who consider infection only when thinking of faulty wound union, may care to compare their results with those of the Staff of the Woman's Hospital, Tables A and B, which show the incidence of infection only, have been prepared.

TABLE A

INCIDENCE OF INFECTION IN 2755 CLEAN ABDOMINAL INCISIONS

	EXTENSIVE INFECTIONS (CLASS C)	SLIGHT INFECTIONS (CLASS B)
1645 Incisions closed by Absorbable Sutures (Catgut closure)	4.7%	5.3%
1110 Incisions closed by Nonabsorbable Sutures (Removable Silk Suture closure)	2.1%	1.9%

TABLE B

INCIDENCE OF INFECTION IN 245 CONTAMINATED ABDOMINAL INCISIONS

	EXTENSIVE INFECTIONS (CLASS C)	SLIGHT INFECTIONS (CLASS B)	DRAINAGE AND EXTENSIVE INFECTION (CLASS C)	DRAINAGE AND SLIGHT INFECTION (CLASS B)
158 Incisions closed by Absorbable Sutures (Catgut)	8.9%	4.4%	19.6%	8.2%
87 Incisions closed by Nonabsorbable Sutures (Removable Silk Sutures)	9.1%	3.4%	17.2%	8. %

A final examination of the six preceding graphs reveal facts, which substantiate Childs' theory that absorbable suture material, such as catgut, used in the closure of the abdominal incision, constitutes the important and avoidable predisposing cause of infection in the tissues about the incision, especially in the more or less avascular fatty layer, which possesses lower powers of resistance to infection than the fascia and skin which lie on either side of it. Furthermore, the figures show that in the hands of the same surgeon, *with all factors excepting the character of suture material remaining constant*, the conventional catgut closure, which has been so generally adopted as the method of choice, gives results inferior to those which follow the closure of the wound by removable nonabsorbable suture material, such as silk.

The site of the abdominal incision is believed by some to be a factor in wound infection. Some surgeons are firmly of the opinion that the longitudinal median type of incision is less likely to become infected than the transverse suprapubic type, while others believe the contrary. In this study it has been found impossible to make a definite statement on this point because of the fact that no one surgeon has used both types of incision a sufficient number of times to warrant a conclusion. It is interesting to note, however, that Surgeon 3, who has used the catgut closure only, has met with an incidence of faulty union of 14.8 per cent in a series of 108 clean transverse suprapubic incisions and of 12.6 per cent in a series of 95 clean longitudinal incisions, while Surgeon 9, who has employed the removable silk suture method of closure only, has met with an incidence of faulty union of 2.4 per cent in a series of 165 clean transverse incisions and of 4.2 per cent in a series of 96 longitudinal incisions. It will be noted that the incidence of faulty union of 2.4 per cent in 165 clean transverse suprapubic incisions represents the lowest incidence of faulty union in the entire series studied. It is obvious, therefore, that the incidence of faulty wound union can be kept as low, if not lower, in the transverse type of incision than in the longitudinal incision, despite the general belief that the transverse type of wound is the more likely to become infected.

From an economic viewpoint faulty union in the abdominal incision is a costly and time-consuming complication to both patient and hospital. In the series of 3,000 cases under consideration there has been a total loss of 3,086 hospital days due to defective wound union. In the series of 2,755 incisions, clean at the time of operation, 248 failed to unite by primary union with a loss of 1,587 hospital days, while in the series of 245 contaminated incisions 193 failed to unite by primary union with a loss of 1,499 hospital days. It is difficult to calculate, with any degree of exactness the loss of hospital days which might be considered justifiable in this or any other series of cases. It is obvious, however, that no other postoperative complication with which the abdominal surgeon meets is responsible for a loss of time comparable to that caused by faulty union of the abdominal incision made and closed by conventional methods.

It is to be regretted that time has not permitted a study of end-results in the entire series of cases, especially in regard to the incidence of postoperative hernia. The study will be made in the future.

A review of the material studied leads to the following conclusions:

1. If correct standards are rigidly applied in the recording of wound union, faulty union in abdominal incisions, made and closed by standard methods, constitutes the commonest postoperative complication in abdominal surgery.

2. The most important predisposing causes of faulty wound union in the order of importance are absorbable suture material (catgut), trauma, and poor technic.
3. The principal exciting cause of faulty wound union is infection.
4. In the series of cases studied, the average incidence of faulty wound union from all causes in clean abdominal incisions closed by absorbable suture material has been 12.1 per cent, while in clean incisions closed by nonabsorbable suture material it has been 4.3 per cent.
5. The average incidence of *infection* in clean abdominal incisions closed by absorbable suture material has been 10 per cent, while in clean incisions closed by nonabsorbable suture material it has been 4.0 per cent.
6. The average incidence of faulty wound union from all causes in contaminated abdominal incisions closed by absorbable suture material has been 83.5 per cent, while in contaminated incisions closed by nonabsorbable suture material it has been 70.0 per cent.
7. The average incidence of *infection* in contaminated abdominal incisions closed by absorbable suture material has been 41.1 per cent, while in contaminated incisions closed by nonabsorbable suture material it has been 37.7 per cent.
8. With the methods available at the present time the incidence of faulty wound union from all causes should not exceed 5 per cent in clean incisions and 70 per cent (including drainage as a cause of faulty wound union), in contaminated incisions.
9. A comprehensive classification of wound union will take into consideration not only infection as a cause of faulty wound union but all other causes as well.

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[1]Moynihan, Sir. Berkley: Abdominal Operations, 1916, i, 105.
[2]Child, C. G.: Closure of the Abdominal Incision, Jour. Am. Med. Assn., January 19, 1907, xlviii, 221.

ABDOMINAL PREGNANCY*

By E. A. Bullard, M.D.

(Junior Attending Surgeon)

Mrs. A. M., white, age thirty-two, was admitted to Woman's Hospital on Dec. 10, 1923, with a temperature of 104.6°, pulse 125, white count 11,000, with 89 per cent polys, red cells 3,850,000 and hemaglobin 80 per cent. She was vomiting occasionally, had a chill on admission, and complained of frequent pains in lower abdomen.

Patient had enjoyed excellent general health up to the present illness. Menstrual history had been normal; married five years; and pregnant for the first time; her last menses having occurred July 18th to 21st.

Three weeks before entering the hospital she fell, striking her abdomen against a railing. This was followed by several days of severe abdominal cramps and moderate uterine bleeding. For a week or so she felt generally better, then the pains returned she began to have fever and chills and she was referred to the hospital.

Our first examination noted a well-developed young woman obviously seriously ill. The abdomen was moderately distended, tympanitic and very tender everywhere. Vaginal examination revealed a symmetrical uterus apparently five months' pregnant. The cervix was soft, not dilated and no bleeding present. Repeated auscultation failed to discover a fetal heart.

A diagnosis of accidental hemorrhage with partial separation of the placenta, death of the fetus, and infection was made.

As the patient's condition seemed to be growing worse, we felt that the uterus should be encouraged to expel its probably infected contents. Accordingly, three days after admission, a rubber tube and gauze were packed into the cervix and lower uterine cavity. This was repeated but failed to excite uterine contractions. Finally, on Dec. 20, six days after the first attempt at induction of abortion, as the patient's general condition was decidedly worse, vaginal cesarean section was undertaken. To my amazement, after I had split the anterior lip of the cervix, I found the uterine cavity only four inches deep and empty. We now realized that we had an ectopic pregnancy to deal with, but because of the patient's very poor condition I decided not to add any more operative shock that day.

On the following morning the picture of general peritonitis was more severe; pulse feeble and averaging 140, temperature 103°, abdominal distention pronounced and vomiting frequent.

Under local anesthesia the abdomen was opened rapidly. Foul smelling bloody serum and many old clots welled out and peritonitis was obvious. A large placenta was found in the left lower abdomen well above the uterus and apparently attached only to loops of intestines. Lying behind the placenta with its head upon the bladder was a fetus of about five months. I cautiously extracted the fetus which was dead but not macerated, and ligated and cut the cord. Delivery was followed by a profuse gush of fresh blood, undoubtedly from accidental separation of some portion of the placenta. This hemorrhage was promptly stopped by packing five large laparotomy pads under the placenta. The incision was rapidly closed with the tapes attached to the gauze pads protruding from the lower end,

*Abstract of article read before the New York Obstetrical Society, Meeting of October 14, 1924.

Reprinted from *The American Journal of Obstetrics and Gynecology*, January, 1925, ix.

and the patient left the table seemingly no worse for the operation. A transfusion of 500 c.c. of blood was given immediately by the Unger method. In spite of this her condition became steadily worse and she died about four hours later.

The following extracts were taken from the autopsy report of Lawrence Strong.

Two thousand cubic centimeters of bloody serous fluid free in the abdomen,—most purulent in the upper abdomen. A placenta fifteen centimeters (15 cm.) in diameter presents in median line and extending to the left. It is attached to sigmoid, descending and transverse colon, to small intestines and perinephric tissues of left side. All points of attachment to the gut are dark red and greenish; in places the attachment is very firm and cannot be separated, while for the most part the attachment is loose and necrotic. No trace of membranes. Liver shows fatty degeneration. Kidneys show cloudy swelling. Uterus measures 10 x 12 cm. at fundus and wall 3 cm. thick there. Mucosa rough and hemorrhagic, does not appear thickened. Right tube 12 x 1 cm., fimbric extremity obliterated, lumen admits probe. Left tube 9 x 1 cm., lumen not visible, does not admit probe. The outer extremity was continuous with the sac of the ectopic. Neither ovary identified, microscopic examination showed.

Right tube near outer end shows minute lumen with few rudimentary plicae and muscular wall slightly developed.

Left tube; outer end more rudimentary than right, no plicae. Section from tip of left tube shows some plicae which are short and low.

Section from left mesosalpinx shows a few corpora fibrosa in a dense ovarial stroma. This was from a whitish nodule 1 cm. in diameter. No ovarial tissue discovered on right side.

We have here a uterus hyperplastic to the degree consistent with a well advanced ectopic gestation. The hyperplasia is of the muscular wall and not decidual. The tubes are of approximately normal length but markedly aplastic in muscular wall and mucosal development. This is explicable either as rudimentary development of the tubes or possibly as representing the isthmic portions greatly elongated through tension. This latter explanation does not obtain, however, since the condition is bilateral and neither tube shows any ampullary portion. The ectopic gestation is an abdominal one, presumably originating on the left side since the right fimbric extremity was closed. Neither tube exhibits any sign of an original tubal nidation (hemorrhage, or inflammatory reaction). We have one atropic ovary, the left, at a considerable distance from and entirely uninvolved in the gestational tissues. Since no trace of the right ovary was found, of course we cannot deny the possibility of a right ovarial nidation, but there is nothing to suggest this.

LYMPHANGIOMA OF THE FALLOPIAN TUBE

By Lawrence W. Strong, M.D.
(Consulting Pathologist)

THE occurrence of a lymphangioma in the fallopian tube is sufficiently rare to justify a report of two cases which have been found in the routine examination of tissues at the Woman's Hospital.

The literature on the subject contains but five cases, four of which are referred to in Veit's *Handbuch der Gynaecologie*, v, 190 and also in Liepmann's *Handbuch*, ii, 177. The fifth case is one of O. Frankl's described by Leighton in the *American Journal of Obstetrics and Gynecology* for 1912, and also referred to in Liepmann's *Handbuch*.

Since the distinction between a lymphangioma and a local dilatation or lymphangiectasis may be regarded as rather indefinite, it is important to note that these five reported cases are all described as true tumors by Frankl, and by Fromme and Heynemann who wrote the article for Veit's *Handbuch*.

Dilatations of preexisting channels do not take the form of circumscribed nodular tumors; and they occur only where there is a physical cause, namely, the accumulation of secretions or foreign matter requiring removal. No such static conditions were present in the accompanying cases; the tubes were in all other respects normal.

A brief description of the two additional cases is here given:

Case 1.—Path. No. 18104. A married woman, forty-eight years of age was admitted to the service of Dr. Ward for an abdominal tumor. At operation a large symmetrical tumor of the ovary was found, and a complete hysterectomy was done.

The pathologic report described a uterus of normal mucosa. One ovary was replaced by an irregular solid tumor of dense fibrous tissue extending into the ligamentum ovarii almost to the tube corner. About 1 cm. from the isthmic extremity of the tube and embedded in its wall was a firm nodular tumor of about 5 mm. diameter. Microscopic examination of uterus and ovarian tumor showed fibrosis of the myometrium and a fibroma of the ovary. The nodule in the tube showed obliteration of the tubal lumen with replacement by fibrous connective tissue and round cell infiltration. The nodule itself consisted of a mass of lymph spaces lined by a regular endothelium which here and there was undergoing proliferation. The nodule was surrounded by normal musculature.

Case 2.—Path. No. 24096. A married woman, fifty-two years of age was admitted to the service of Dr. Grad for pelvic pain and hemorrhage. At operation a retroverted uterus was found, giving a purulent discharge from the os. A complete hysterectomy was done.

The pathologic examination showed a large, boggy uterus with a stenosed internal os. The ovaries were somewhat enlarged and showed numerous cysts of the follicles. The tubes were of normal size, moderately convoluted, and a well-defined hard nodule was felt in the wall of one. A section of this nodule was taken.

Microscopic examination of this nodule showed a reticulum of connective tissue with large spaces of rather uniform size lined by a simple flat endothelium showing no tendency to proliferate. The nodule is about one half cm. in diameter. The margins merge without definite boundaries into the connective tissue of the tubal wall.

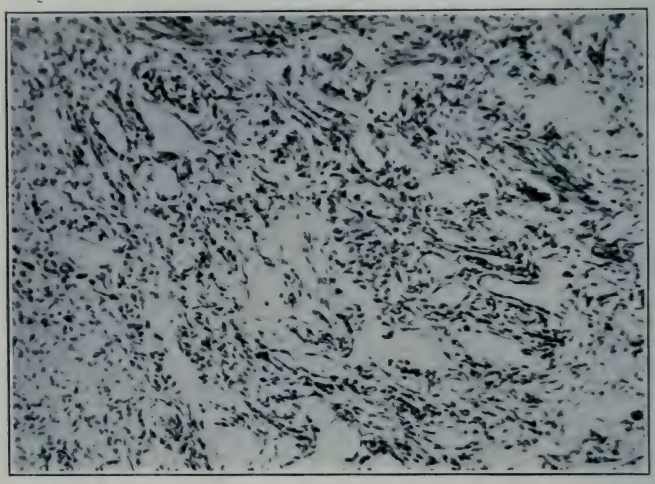

Fig. 1.—18104—Lymphangioma of tube.

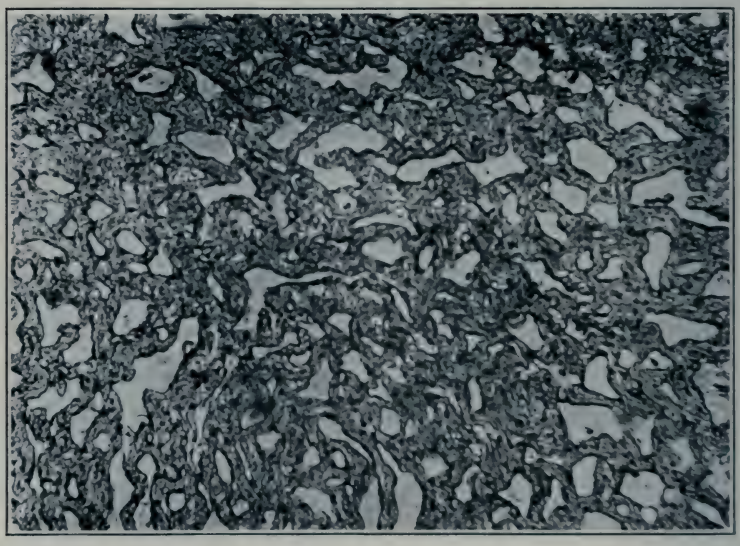

Fig. 2.—24096—Lymphangioma of tube.

In both these cases a localized nodule was observed macroscopically and removed for microscopic examination, which makes them entirely comparable with the five cases already reported. It would appear that these two were as distinctly tumors as are the ones recognized by Frankl and others, although they were perhaps smaller than some. Leighton speaks of Frankl's case as the smallest.

The descriptions of all the seven cases, including the present two, so closely resemble each other that the influence may be drawn that this is a characteristic, even though very rare, neoplasm of the fallopian tube. Its small size and the fact that it has always been an accidental find make it plausible that its rarity is more apparent than real.

There is nothing in the clinical history of these cases which has any apparent bearing on the tumors.

The two of the present report are, however, of value because they were not associated with myomata as were all the previous ones. This controverts the inference made by Leighton that there is a relationship between the lymphangiomata and myomata. Both of my cases were associated with inflammatory conditions, although in both instances the tubes were of normal size with patent fimbric extremities.

The fact that myomata or adnexal disease was present in all cases indicates nothing more than a condition for which an operation was undertaken, without which the lymphangioma would have remained undiscovered. These tumors have occurred both in the isthmic and ampullary portions of the tube. They have all been of small size and oval in shape. It has been suggested by Kermauner that they were potentially malignant, on account of the proliferation of endothelium, and he has therefore related them to endotheliomata. There is certainly no appearance of malignancy in the present cases, and they are to be regarded in the same light as lymphangiomata of the skin and elsewhere. A certain amount of proliferation of endothelioma, however, is characteristic of all lymphangiomata.

ISTHMOSPASM OF THE FALLOPIAN TUBE*

Illustrated by Cases From the Clinic of the Woman's Hospital

By William T. Kennedy, M.A., M.B. (Tor.)

(Junior Attending Surgeon)

STERILITY, dysmenorrhea and anteflexion in cases where no pathologic condition can be found must have as its cause some variation from the normal.

After the examination of the male has revealed numerous normal motile spermatozoa, and after the examination of the female has shown no pathologic condition of the genital tract from the vulva to the ovary, sterility is still a puzzle to the gynecologist. Factors, such as incompatibility of man and wife, stenosis of cervix, anteflexion of the uterus, etc., are laid down as causes, but they may be only steps in a chain in the individuals having a general hypertonic condition of all muscle fibers, especially the circular smooth muscles, sometimes the autonomic nerve fibers predominating and at other times the sympathetic.

Haas[1] describes the hypertonic infant and the successful treatment of hypertonic stenosis and pylorospasm with atropine. Whether or not this and other hypertonic tendencies extended into adult life, we do not know, but it is quite possible it is present to a certain degree in the so-called neurosthenic individual. Williams[2] describes a longitudinal muscle in the normal isthmus which may assist materially in the migration of the fertilized ovum from the fimbria into the uterine cavity, but its inability to contract beneath an hypertonic circular muscle may inhibit or prevent the passage of an ovum. Schmidt[3], describing the condition of the interstitial segment of the tube in pregnancy, believes that only the absence or pathologic course of muscle contractures—more readily possible at the angle of the tube than elsewhere—can be the cause of difficult separation of a placenta at the angle of the tube. Noble[4], discussing anteflexion and dysmenorrhea, suggests that many times dysmenorrhea and sterility are wrongly ascribed to anteflexion and also that pathologic anteflexion is congenital. Rawls[5] observes in dysmenorrhea and sterility that a stricture in the uterine or cervical canal per se, is not sufficient to bar the entrance of the spermatozoa and he believes that this stricture is most often the predisposing cause, and the exciting cause is some change in the mucous membrane of the cervix and the uterus. Reynolds,[6] in the examination for sterility, has observed the existence of spasms in the uterine attachments, the existence of an abnormally low "postcoital" flow associated with a small external os and an anteflexion of the cervix upon the body of the uterus. Polak[7], reporting 299 cases in a paper on ectopic gestation, shows that 94 belong to a type which, following some procedure for the cure of their sterility, have developed an ectopic pregnancy (seven women had this history with recurrent ectopic pregnancies). Polak[8] also states "Where the ectopic has occurred after a long period of sterility in a woman who has never borne a

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child, and the ectopic is the first pregnancy after years of married life, I take it for granted that the tube on the other side is congenitally deformed and I have removed the other tube. I have also removed the other tube in cases where the woman has had a long period of sterility following a definite attack of pelvic inflammation, even though the tube was apparently patent to a fine probe." Sampson[9] speaks of the tube opposite to that which contained an ectopic pregnancy thus, "In very many of the reports in which its condition is mentioned, it is spoken of as normal. It must be frankly acknowledged that we are unable to judge of the capabilities of a tube from its appearance." Smith[10], commenting upon operation for ectopic gestation and repeated ectopic pregnancies reports many a normal tube left on the side opposite to that removed for ectopic gestation. He says "If I may judge from the literature and from my own experience, there is no one type of tube seen at such operations which from its appearance would seem on the one hand to make it especially disposed to a further ectopic pregnancy and give a sufficient reason for its removal; or, on the other hand, to warrant our safely assuming that such an accident would not recur and that a normal pregnancy, if any, would take place." Aldridge[11], reporting the insufflation of the uterus and tubes of 600 cases by the Rubin method, states that "There are undoubtedly conditions which obstruct the passage of gas through the tubes which cannot be seen when the tubes are examined at operation, and it is impossible to say that the tubes are patent because they appear normal to inspection." Meaker[12], speaking of the use of antispasmodic drugs in sterility, says "Muscular spasm in the female pelvic organs is not an uncommon phenomenon. It is a prominent feature of certain types of dysmenorrhea, and has been thought at times to cause stenosis of the os internum of the uterus. From such instances of spasm in the uterus to the idea of spasm affecting the musculature of the interstitial portion of the tube is no very far cry." Rubin[13], to whom we are indebted for the valuable procedure of insufflating tubes, states that "occasionally, in a nonpatent case, that is, where the pressure is high we are ready to conclude, that the patient has occluded tubes, but on second examination we will find the gas goes through." Peterson[14], observing a number of cases through the abdominal incision, found that when the pressure was sufficiently raised the apparent obstruction at the isthmus was overcome and the gas appeared at one or the other extremity. Blair-Bell[15] has said "I think that light will soon be shed on that curious anomaly I call selective sterility . . . . . I have observed, however, that a difference in blood groupings of married couples has no direct relation to the possibility or otherwise, of conception."

From the observations of these authors we are led to believe that anteflexion, dysmenorrhea, and sterility are rather closely related and in many cases are the result of some condition yet undescribed. We are forced to believe that a large number of tubes obstruct the flow of CO_2 gas through them when insufflated, some partially and some completely, but they, when observed and insufflated at operation, allow the passage of CO_2 gas and appear perfectly normal (circular muscles relaxed by anesthesia). One cause of this condition I believe to be a hypertonic contraction of the isthmus of the fallopian tube and recent studies may serve to substantiate such a belief.

PHYSIOLOGY OF THE TUBES AND UTERUS

Halsey[16] finds that pilocarpine and physostigmine excite violent uterine contractions which may become tonic in character, and here as

in the intestine, atropine in small doses causes excitation and in large doses cessation of the movements of the uterus. Toxicologically, it is important to remember that simultaneously with peristalsis, uterine contractions may be reflexly excited by chemical irritation of the intestinal mucous membrane. Macleod[17] says "Pituitrin acts directly on involuntary muscle fibers themselves." From the recent physiologic study of the tubes, uterus, and cervix by Whitehouse and Featherstone[18] we may surmise that there is some local center apparently controlling peristalsis and since peristalsis begins near the junction of the tube and the uterus, it might be logical to assume this center to be in or near the isthmus. Any hypertonic condition would probably have its origin here also and be proportional to the degree of stimulation of autonomic innervation over the sympathetic innervation; and may produce an abnormal contraction of the circular muscle even to obstruction. Let us recall pyloric stenosis. The pylorus is innervated by the autonomic nerve branches which supply the circular muscles and by the sympathetic fibers which probably supply the longitudinal muscles. Stimulation of the autonomic causes violent contraction of the circular smooth muscles but stimulation of the sympathetic produces intestinal relaxation. The balance of the two innervations produces no symptoms, but hyperautonomic innervation causes obstruction. Two cases were reported by Hirschsprung, in 1888, but it was not until 1896 that Thomson first published his description. Now, its occurrence is quite frequent. It is amenable to medical and surgical treatment. Similarly, may the isthmus of the fallopian tube not respond? We recall that adrenalin, stimulating the sympathetic and atropine paralyzing the autonomic produce this effect in bronchioles and intestines and should do so in the tubes, uterus, and cervix. By deduction we might expect to find dysmenorrhea relieved by atropine or by hypodermic adrenalin. Cases 1 and 2 will illustrate the above deduction.

Case 1.—Patient aged twenty-seven entered our service on account of sterility. Wassermanns of both husband and wife were negative. An operation for retroversion was done. She became pregnant and had a miscarriage. Six other miscarriages followed. During the eighth pregnancy, more or less uterine contractions began about the third month accompanied by spells of nausea with rather frequent vomiting, even though confined to bed. The patient was given atropine, hyocyamus and benzyl benzoate with the result that both the uterine contractions and the pyloric contractions were relieved for the next seven weeks, but the patient eventually aborted. Thus, isthmospasm (if we look upon uterine contractions as beginning in the isthmus) and pylorospasm were simultaneously present in the same patient and both were temporarily relieved by antispasmodics.

Case 2.—Patient aged twenty-seven. Dysmenorrhea since menstruation began. Menstrual cycle—12x28x7; pain severe for four days; small clots for the first two days. Breasts swell during menstruation. Married five years; pregnant four years ago. Miscarried at six months following an injury. Operation three years ago in the Edinburgh Infirmary, when both tubes were resected (report only recently received). Operation at Woman's Hospital, July, 1923. Dilatation and

curettage, stem pessary. Pathologic examination of uterine curettings showed premenstrual uterine mucosa. Her convalescence was normal. Stem not removed until Sept. 19, 1923. October, 1923, there was no relief from symptoms. January, 1924, her condition was unchanged. Tubes insufflated, pressure 200 mm. of mercury; five trials, tubes were occluded. In February and March, the uterus and tubes were dilated with CO_2 gas just before menstruation with slight relief of dysmenorrhea. In April, tubes and uterus were again dilated with CO_2 gas and 6 minims of 1:1000 solution of adrenalin injected into the anterior lip of the cervix with the result that at this menstruation there was scarcely any pain. The May menstruation, followed treatment as in April, with the result that the patient had no pain. The June period came on a day or two early, so dilatation was not done and adrenalin not given, yet there was no pain during this menstruation, then adrenalin was discontinued and dysmenorrhea began to recur gradually and is now as severe as ever.

DIAGNOSIS

Symptoms.—There may be but one symptom—sterility; or there may be two symptoms, sterility and dysmenorrhea.

Signs.—(1) Before operation. (2) During operation. (3) After operation.

Before Operation.—At present only one preoperative sign has been observed by radiographing those tubes which are occluded at their fimbriae. (It will be seen that certain tubes occluded at their isthmi can be placed in this class). A further analysis of cases which I have presented in a previous paper[19] shows that of six cases where the tubes were occluded at their isthmi, four had anteflexed and two had normally flexed uteri; also, of six cases where the isthmi were able to contract and empty their contents of 20 per cent solution of sodium bromide in either direction, four had anteflexed uteri, one a normally flexed and one a retroverted uterus.

Fig. 1 illustrates a normal isthmus throughout its entire length. Fig. 2 shows that type of tube where the isthmic canal was emptied by the contraction of its circular muscle but the uterus and the ampulla of the tube remain full. This patient's uterus was moderately anteflexed and she complained of sterility and dysmenorrhea. More than a year later a patient came complaining of sterility and dysmenorrhea whose left tube had been previously removed for an ectopic pregnancy. It was deduced from the previous observation that we were dealing with a tube having its circular isthmic muscles hyperactive. Fig. 3 illustrates our deduction. A later operation done for adhesions revealed an apparently normal tube.

During Operation.—Peterson reports tubes occluded to CO_2 gas insufflation, which during operation appeared normal and allowed the passage of gas through their isthmi, i.e., when relaxed by anesthesia.

After Operation (miscroscopic).—This observation was made by removing both isthmi from one patient and one isthmus from another patient, then serially sectioning and staining them. The following paragraphs give a brief summary of the two cases:

Case 4.—Aged twenty-three; married at age of eighteen; came complaining of sterility and dysmenorrhea. Menstruation which began at age of fourteen was irregular; duration three days, with pain. There was history of pelvic inflamma-

Fig. 1.

Fig. 2.

tion. The uterus was small, anteverted, but not anteflexed. Cervix was soft. Left adnexa was thickened with small ovarian cyst. The tubes were insufflated by Aldridge and reported occluded. The spermatozoa of her husband were poorly developed and few in number. Operation, May 13, 1921, showed uterus and right

Fig. 3.

Fig. 4.

ovary normal. Left ovary had a cyst about 3 cm. in diameter in its wall. Both ampullae of the tubes were normal in every way except that one fimbria of the left tube was attached to the posterior portion of the broad ligament by a single fine adhesion. Neither isthmus would pass a fine probe. The left isthmus was normal in appearance but felt as though it contained a "fibrous core." The

right isthmus was larger and felt as though it contained a larger "fibrous core." It was decided that the seats of obstruction were the isthmi, so both isthmi were excised and a hystero-salpingo-anastomosis (first done by Thomas J. Watkins[20], see also Reis[21], and Shaw[22] (was done after the method described by me[23]). Although the dysmenorrhea has gone and gas has passed through the tube at pressures lower than 100 mm. of mercury on two occasions, one and two years respectively since operation, the patient has not yet become pregnant. Both isthmi were serially sectioned, stained with hematoxylin-eosin, and with Van Gieson's stain. The canals of both isthmi revealed slight variation in size, were not small, were not constricted and were patient. Both walls had normal musculature, showed no nodules and no evidence of any inflammatory condition. The muscle wall of the right tube was considerably thicker than that of the left and its epithelium was slightly irregular in shape and slightly atrophic in appearance. In short, the tubes were very practically normal. We may conclude in this case that normal isthmi did obstruct the flow of CO_2 gas during insufflation at 200 mm. mercury pressure, and that after these isthmi were removed CO_2 gas easily passed through these tubes.

Case 5.—Patient aged twenty-seven, married five years, came complaining of sterility and dysmenorrhea. Tubes were occluded. Husband had two children by first wife. The patient, the second wife, was told she had had salpingitis eight years ago. The uterus was small, anteflexed, retrocessed; adnexa negative. Radiogram—20 per cent solution of sodium bromide, 200 mm. mercury pressure—showed the right isthmus occluded, the left fimbria occluded and the uterus acutely anteflexed. Fig. 4 illustrates the right tube. At operation the ampulla of the right tube was found normal; the isthmus, which throughout its length was extremely small, and had a core-like canal approximately 1.5 mm. in diameter, was excised, serially sectioned and stained but no obstruction was found. Hence, another tube with a microscopically normal isthmus obstructed the passage of CO_2 gas and the passage of the solution of sodium bromide at 200 mm. mercury pressure before operation. Thus, a tubal isthmus appearing microscopically normal, can have a patent canal and yet be obstructed. Doubtless more such tubes exist and their isthmi, while anatomically normal, have a physiologic abnormality of hypertonic circular muscles.

TREATMENT

Such a tube presents itself to us for some treatment other than that in present use. The stem pessary, temporarily relieving spasm and restoring uterine peristalsis; dilatation of the cervix, paralyzing for a time the cervical musculature; and the negative electrode also relieving the spasm are among the present methods used in relieving dysmenorrhea. But oftentimes these are only temporary and our results for ameliorating anteflexion and dysmenorrhea and for relieving sterility will only be lasting when we can consistently relieve isthmic and uterine spasm and restore the normal peristalsis of this organ. Antispasmodics may help us. But deranged metabolism may be the seat of the cause and show itself either in an overstimulated autonomic or an exhausted sympathetic nervous system.

CONCLUSIONS

1. Isthmospasm of the fallopian tube is one obstruction between the meeting of the ovum and the spermatozoa and may be the only obstruc-

tion preventing the passage of a fertilized ovum from the tube into the uterus—a predisposing factor in ectopic gestation.

2. Isthmospasm is one condition which will explain selective sterility.

3. Attenuation of an isthmospasm would explain some delayed conceptions.

4. Isthmospasm exists in some individuals complaining of sterility, or sterility and dysmenorrhea and is frequently associated with anteflexion.

5. Isthmospasm is caused by the improper balance of the automic and sympathetic innervations either the autonomic being in excess or the sympathetic being deficient.

6. That a tube, having an apparently normal ampulla and no evident abnormality of the isthmus even though it obstructs the passage of carbon dioxide gas by insufflation should not be removed at operation because we may render a patient permanently sterile who is now only temporarily so.

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DECIDUAL REACTION IN THE FALLOPIAN TUBE*

By Alfred Plaut, M.D.
(Pathologist)

DECIDUAL reaction in the fallopian tube is a somewhat rare condition, and it is difficult to explain why it occurs in one case, and not in another. Perhaps, as someone has suggested, it would be better to ask why it does not occur in the majority of cases. When the ovum is implanted in the mucosa of the uterus, the endometrium reacts, but the fact that the decidual reaction of endometrium is to be found in every case of ectopic pregnancy shows that it is not the irritation by the ovum which causes the decidual reaction.

The case I wish to report is that of a woman twenty-five years old with the clinical signs of ectopic pregnancy. A typical specimen was removed at operation. It was a pear-shaped tube which after hardening and cutting showed the usual picture of a huge blood-clot without details. On microscopic examination I could not find any remnants of the embryo itself, and only after a long search some chorionic villi were found. They were in different degrees of necrosis and partly surrounded by leucocytes. In the ampulla of the tube, where the hemorrhage was located, the wall showed only uncharacteristic layers of fibrous tissue and muscle-fibers, and a long search was again required to find a few mucosa folds. They were thin, compressed, but otherwise quite normal. However, near the middle of the tube on the point where the thickening made by the hemorrhage subsided, the stroma of the tubal mucosa showed the typical decidual reaction.

There is no question about the decidual reaction here; the lantern slide and microscopic examination show all the characteristics necessary for this diagnosis. Flattening of the epithelium in those parts of the folds where the reaction took place can be seen, and even where only a few of the stroma cells underwent the swelling, the epithelial cells covering them are flatter than their neighbors. The whole length of the folds is not changed in an equal degree; the basal parts are not changed, and the swelling of the cells is more marked near the end of the fold. This seems to be the rule, as other authors report the same findings. However, the isthmus of the tube was perfectly normal, and in this case the rule found by others does not apply, that the decidual reaction in the tube is more marked as we go away from the point of implantation.

The question arose if in this case the serosa of the peritoneum showed decidual reaction in a higher degree than usually, as found by Schmorl. Since the patient did well after the operation, only the appendix could be examined, and in its serosa no decidual reaction was to be seen.

A NEW ANATOMIC FINDING IN THE APPENDIX

Under the slightly thickened serosa of the appendix, gland ducts surrounded by lymphatic tissue, were lying. Their resemblance with the glands in the mucosa of the appendix is almost complete in the form of the cells and of the nuclei,

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in their staining, in the surrounding lymphatic elements, and even the product of the secretion of these intestinal epithelial cells can be seen. I do not know whether they are in connection with the mucosa, as I could not do serial sections. Nevertheless, I see no other possible explanation. I do not think that serosa cells which by some inflammatory process can assume gland-like formations can give a picture like this, and I cannot see how the surrounding lymphatic tissue can be explained by this. The appendix has been studied in such tremendous numbers that I was astonished not to find in the literature a report of a thing like this; it must be extremely rare.

NOTE: Since presenting this paper, I have had the opportunity to compare my slides with slides of endometrial serosa adenomyosis, which Dr. Sampson of Albany was kind enough to send me. The comparison confirms me in my first opinion that these gland ducts in the serosa of the appendix are not identical with Dr. Sampson's cases, but are intestinal glands.

INSUFFLATION OF UTERUS AND FALLOPIAN TUBES*

Report of 600 Cases Examined by the Rubin Method

By Albert H. Aldridge, M.D.
(Adjunct Assistant Surgeon)

A STUDY of the Rubin method for the determination of tubal patency was begun at the Woman's Hospital two years ago.

The apparatus and technic which were adopted for this study were essentially the same as originally described by Rubin.[1] The apparatus as shown in the diagram (Fig. 1) consists of a pressure tank (A) filled with carbon dioxide; a reducing valve (B); a 40 c.c. siphon flow meter (C) which is immersed in tap water in a wide-mouthed one liter bottle (D); a mercury manometer (E) and an intrauterine canula (F). The intrauterine canula (F) consists of a Keys Ultzmann canula over which the rubber tip of a male anterior urethral syringe has been fitted to close the cervical canal. The outlet of the reducing valve (B) is connected to the inlet of the siphon flow meter (C) by pressure tubing (G) upon which is placed a compression clamp (H). The mouth of the one liter bottle is made air-tight by a two-hole rubber stopper (I). The inlet of the siphon flow meter (C) is passed through one hole of the two-hole rubber stopper and a glass "Y" tube is passed through the other. The glass "Y" tube is connected one way with the mercury manometer (E) by pressure tubing (L) and the other way with the intrauterine canula (F) by pressure tubing (M) leading to the intrauterine canula.

By use of this apparatus the following important details in the technic can be accurately controlled and a maximum amount of information obtained from examination:

1. A constant low pressure of gas can be automatically maintained by the reducing valve (B).

2. The rate of flow of the gas can be accurately regulated by means of the compression clamp (H) on pressure tubing (G).

3. The volume of gas which passes into the abdomen can be measured by the siphon flow meter (C).

4. Intrauterine pressure can be recorded by means of the mercury manometer (E).

In this study cases were classified as patent, partially occluded, or occluded according to the level of intrauterine pressure at which gas passed through the fallopian tubes into the abdomen. For the purpose of this study the levels of pressure suggested by Rubin were adopted. That is:

*Reprinted from *The American Journal of Obstetrics and Gynecology*, July, 1923, vi.

1. If gas passed into the abdomen at an intrauterine pressure below 150 mm. the tubes were considered patent.

2. If a pressure of 150 mm. or more was required before gas passed into the abdomen the tubes were classified as partially occluded.

3. Manometer readings of 200 mm. on repeated trials were considered to indicate occluded tubes.

These levels of pressure for the classification of cases depend upon one very important point in technic, namely, the rate of flow of the

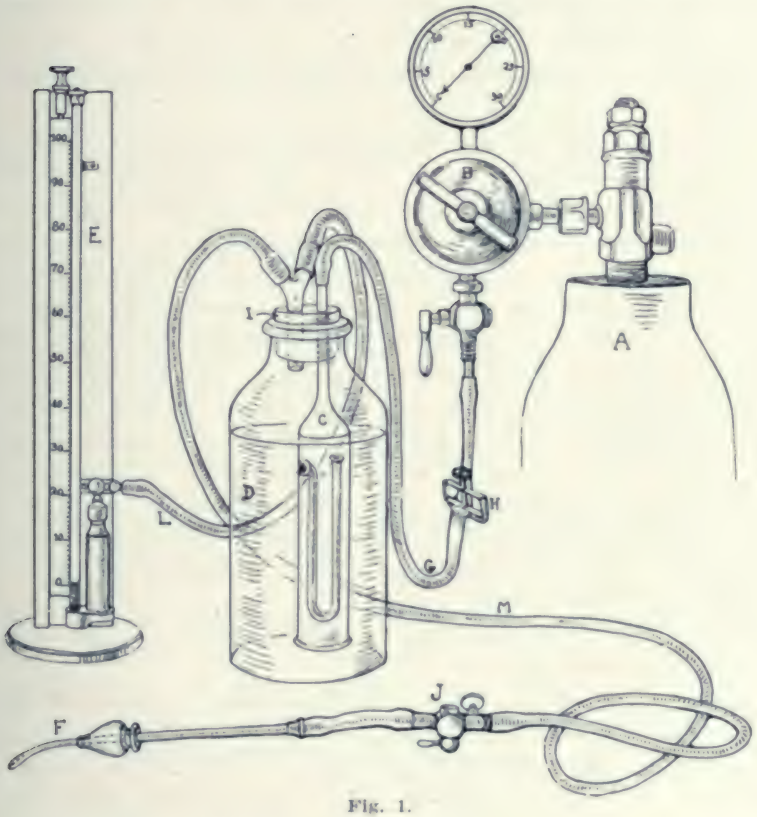

Fig. 1.

gas. Any slow rate of flow may be safely used but levels of pressure indicating patent or partially occluded tubes must be determined for the rate of flow of the gas used during the examination. That is, during inflation of the uterus and tubes gas is allowed to accumulate under pressure in an enclosed chamber, the uterus, which has a narrowed outlet represented by the tubes. Practical experience has shown that, when the gas flows at a very slow rate, a drop in the intrauterine pressure, indicating that gas has passed into the abdomen, occurs at a lower level than when the gas is allowed to flow at a more rapid rate. As stated above the tubes were classified as patent, or partially occluded according

to the level at which the pressure fell. The necessity for adopting a known uniform rate of flow of the gas to determine the condition of the tubes is therefore apparent. In this series a rate known as 20 to 100 suggested by Rubin was adopted. This rate of flow of the gas is obtained before the examination is begun. To obtain this rate of flow—

1. Regulate the reducing valve (B) so that it will maintain ten pounds of pressure.

2. Close the release valve (J) making the pressure system air-tight.

3. Adjust the rate of flow by means of the compression clamp (H) so that a pressure of 100 mm. will accumulate in 20 seconds as indicated by the manometer.

4. The release valve (J) is then opened until the canula is adjusted in the cervical canal.

In this way the exact rate of flow of the gas can easily be obtained before the examination is begun. It is a much more accurate method to determine the rate of flow than to count the number of pulsations or excursions of the gas in the siphon flow meter.

The technic of the examination has been kept as simple as possible. The patient is examined in the lithotomy position. Exposure of the cervix is obtained with a bivalve speculum. The cervix and cervical canal are painted with 3.5 per cent iodine. The anterior lip of the cervix is grasped crosswise with a bullet forceps in order to leave the canal unobstructed. The intrauterine canula is then inserted into the canal. The rubber syringe tip which has been placed over the end of the canula is made to fit into the canal as firmly as possible, by gentle downward traction on the cervix with bullet forceps. The screw release valve is then closed and the manometer will immediately begin to register intrauterine pressure.

We have three ways of knowing whether gas has passed into the abdomen during examination:

1. Pressure findings.—A drop in intrauterine pressure during the examination, if there has been no leak around the canula in the cervix, means that gas has passed through one or both tubes. An intrauterine pressure of 200 mm. on repeated trials indicates that both tubes are closed.

2. Shoulder pain.—As soon as the patient assumes the upright position she may have pain in one or both shoulders. This symptom is present in over 90 per cent of the cases in which gas has passed into the abdomen and is very positive evidence that the tubes are patent.

3. Fluoroscopic examination.—If a patient is examined in the upright position with the fluoroscope after gas has passed into the abdomen a layer of gas can easily be seen beneath the diaphragm.

At first all cases were routinely examined with the fluoroscope to determine whether gas has passed into the abdomen. This was later given up except in cases where the patient had no shoulder pain. Many

patients are very apprehensive and fear examination on account of the pain which it may cause. Most patients do have some discomfort during the examination. As soon as they assume the upright position a high percentage of the cases in which gas has passed into the abdomen have shoulder pain which may be rather severe. If they are then taken into the dark room for fluoroscopic examination a certain number will faint as a result of fear and shoulder pain. After 200 cases had been insufflated and routinely examined with the fluoroscope it was decided that if a definite drop in intrauterine pressure during the examination was followed by shoulder pain, no further proof that gas has passed into the abdomen was necessary. It is undoubtedly advisable to examine patients with the fluoroscope if a drop in pressure occurs which is not followed by shoulder pain.

The volume of gas which has passed into the abdomen can easily be measured by counting the number of pulsations or excursion of the gas in the siphon flow meter. Forty cubic centimeters of gas pass into the abdomen with each excursion. About 240 c.c. of gas are used during an examination. Carbon dioxide is absorbed so rapidly from the abdomen that symptoms from the amount used in the ordinary examination disappear after fifteen to thirty minutes.

Patients have not been examined in the presence of profuse purulent or bloody vaginal discharge. Examination should not be attempted in patients who have acute pelvic inflammatory disease or serious organic heart disease.

Too much reliance should not be placed on one examination if pressure findings indicate any degree of obstruction to the passage of gas through the tubes. The results of an examination, when a patient is near her menstrual period, are not reliable. She should not be examined within one week before or after her period. The congestion of menstruation may cause partial or complete obstruction of the tubes. Although a patient's periods may be normal and regular almost every woman has irregular periods at some time during her menstrual life. Therefore we can never be absolutely sure at one examination that we are not too near a menstrual period. For some reason certain cases will be found occluded at one examination and patent at subsequent examinations. If we find the tubes obstructed at one examination and we can find no cause for the obstruction, the patient should be examined at least twice more on different occasions before a definite decision is made in regard to patency of the tubes.

The test has been used mainly for four purposes:

1. To determine the patency or nonpatency of the fallopian tubes in cases of sterility.

2. To determine the patency or nonpatency of the fallopian tubes as an indication of their involvement in chronic pelvic inflammatory disease

or other pelvic pathology when the diagnosis has been uncertain by bimanual pelvic examination.

3. To assist in keeping the tubes open following conservative operative procedures.

4. To determine the ultimate success of operative procedures for opening obstructed tubes.

The results of 600 cases which were examined can be classified as follows:

Primary sterility cases	236
Secondary sterility cases	119
Cases with indefinite pelvic conditions	112
Cases having laparotomies after insufflation	108
Cases examined after pelvic operations (follow-up cases)	25

An analysis of the results of insufflation in 236 cases complaining of primary sterility is as follows:

Tubes patent in 79 cases or 33.4 per cent.
Tubes partially occluded in 69 cases or 29.1 per cent.
Tubes occluded in 88 cases or 37.2 per cent.

In other words 66.5 per cent of the patients complaining of primary sterility had either partial or complete tubal obstruction.

The bimanual pelvic examinations were negative in 44 per cent of the primary sterility cases.

Of the primary sterility cases with negative bimanual examinations, 29.5 per cent had either partial or complete tubal obstruction.

An analysis of the 119 cases of secondary sterility is as follows:

Tubes patent in 56 cases or 47 per cent.
Tubes partially occluded in 26 cases or 21.9 per cent.
Tubes occluded in 37 cases or 30 per cent.

Of the secondary sterility cases 17.4 per cent had either occluded or partially occluded tubes in spite of negative bimanual pelvic examinations.

These statistics point out definitely the value of the method for the diagnosis of a frequent cause for female sterility. It was rather surprising to find the tubes partially or completely obstructed in such a high percentage of sterility cases in which the physical examinations were negative.

The patency of the tubes was studied in 112 cases to determine whether they were involved in chronic adnexal disease. The results were as follows:

Tubes patent in 54 cases or 48.2 per cent.
Tubes partially occluded in 20 cases or 17.8 per cent.
Tubes occluded in 38 cases or 33.8 per cent.

Of the cases with partially occluded or occluded tubes 18.9 per cent had negative bimanual examinations.

The cases having laparotomies following insufflation may be analyzed as follows:

Twenty-one (21) cases were operated for retroversion in which the tubes appeared to be normal. Although the tubes appeared to be normal, 42.8 per cent showed partial or complete tubal obstruction before operation. This undoubtedly explains why certain cases of retroversion are sterile. Insufflation would help to indicate which of these cases should be operated although they are free from symptoms other than sterility.

Other cases in which the results of insufflation were checked at operation included:

31 cases of chronic pelvic inflammatory disease
36 cases of retroversion complicated by chronic pelvic inflammatory disease
10 cases of fibrosis uteri or small multiple fibroids
4 cases in which the tubes were convoluted and of the infantile type.

A large percentage of the pelvic inflammatory cases had definitely occluded tubes at operation. The cases which showed the tubes to be partially occluded when examined by the Rubin method proved to have either one tube open and one closed or both tubes kinked or partially occluded by pelvic adhesions. In certain cases the tubes appeared normal except for congestion. It is possible to have rather marked peritoneal adhesions which do not obstruct the fimbriated ends of the tubes or occlude them by congestion or kinking.

In myomatous uteri the tubes may be partially or completely obstructed without showing disease at operation.

Three out of four of the cases in which the tubes were convoluted and of the infantile type showed complete occlusion when examined before operation.

Insufflation showed the tubes freely patent in three cases operated for right salpingitis and in two cases operated for bilateral salpingitis. Appendicitis caused the symptoms in two of the cases, a unilateral cystic ovary in one case and bilateral cystic ovaries with varices of the broad ligaments in two cases.

As stated above cases were classified as patent, partially occluded or occluded according to the level of pressure at which gas entered the abdomen. It was found early in this study, when cases were examined at operation after insufflation, that a definite single level of pressure could not be obtained, below which it could be said that tubes were normally patent and above which it could be said that some obstruction existed. One fact which was uniformly very striking was that tubes were very easily obstructed. Any condition which produces

congestion of the pelvic organs such as menstruation, uterine displacements, pelvic inflammatory disease, myomata uteri, fibrosis uteri or ovarian neoplasms may cause partial or complete obstruction of the tubes. It was assumed for this reason that it would be possible to find a very low level of pressure which would indicate that both tubes were not only patent but normal. On the other hand, if a high level of pressure were required on repeated examinations before gas entered the abdomen, some obstruction must be present. Although the series of cases operated following insufflation is still small, the findings indicate that—

1. If gas passes into the abdomen at an intrauterine pressure of 100 mm. or below at 20 to the 100 rate of flow, we may be sure that both tubes are patent and normal.

2. If an intrauterine pressure of 150 mm. or more is required on repeated examinations before gas enters the abdomen, we may be sure that some cause for obstruction exists whether it can be felt by bimanual examination or not.

3. When gas enters the abdomen between 100 mm. and 150 mm. of intrauterine pressure, we must combine our pressure findings with other means of diagnosis to determine the condition of the tubes.

It is interesting to note in this series of 600 cases that gas entered the abdomen:

At 100 mm. or less of intrauterine pressure in 142 cases or 23.6 per cent.
Between 100 and 150 mm. intrauterine pressure in 91 cases or 15.3 per cent.
Between 150 and 200 mm. intrauterine presure in 157 cases or 26.1 per cent.

The tubes were occluded in 210 cases or 35 per cent.

In other words we could be reasonably certain that both tubes were normal in 23.6 per cent of the cases and that there was some cause for partial or complete obstruction in 61.1 per cent of the cases. The percentage of cases in which gas entered the abdomen between 100 and 150 mm. was small, 15.3 per cent. This represented the cases in which the method did not give definite information as to the condition of the tubes.

As stated above, the tubes are very easily obstructed. Therefore when we find them freely patent we may be quite sure that they are also normal. If any obstruction is present at repeated examinations, some cause for obstruction is also present, whether we are able to find it or not by physical examination. As seen from the above statistics the method was of definite value in determining the condition of the tubes in 84.7 per cent of the cases examined.

There are undoubtedly conditions which obstruct the passage of gas through the tubes which cannot be seen when the tubes are examined at operation. This is particularly true in the presence of uterine displacements. As noted above 21 cases were operated for uncomplicated retroversion in which the tubes appeared to be normal, although 42.8

per cent showed partial or complete tubal obstruction when examined before operation. It has frequently been observed that cases examined too near a menstrual period had partially or completely obstructed tubes. If the same cases are examined at a later date well away from their periods, the tubes are normally patent and would probably appear normal to inspection. It is obviously impossible to say that tubes are patent because they appear normal to inspection.

A summary of the examination of twenty-five cases following pelvic operations, "follow-up cases," is as follows:

Both tubes removed, 5 cases, partially occluded, 3, occluded, 2.
One tube removed, 4 cases, partially occluded, 2, occluded, 2.
Both tubes resected, 4 cases, occluded, 4.
One tube resected, 3 cases, patent, 1, partially occluded, 2.
One tube removed and one tube resected, 4 cases, occluded, 4.
Salpingostomy, bilateral, 2 cases, occluded, 2.
Cases operated for adherent retroversion, 3, patent, 1, partially occluded, 2.

This very small series seemed to indicate in the cases examined that where the tubes were seriously enough involved to require bilateral resection, bilateral salpingostomy or the removal of one tube and resection of the other, operation failed to open them or to keep them open. A total of ten such cases was examined and all were found occluded. It is also interesting to know that gas entered the abdomen in three out of five cases that had had bilateral salpingectomy.

The test has been used to follow cases of acute pelvic inflammatory disease treated nonoperatively. One case was confined to the hospital for seventeen days with severe pelvic pain, temperature and leucocytosis. Examination at that time showed bilateral tender pelvic masses. She was insufflated one year later when she was entirely free from symptoms. The pelvic examination was negative and the tubes were found freely patent.

A small number of cases were insufflated at intervals following conservative operative procedures on the tubes. These cases were insufflated in order to prevent the tubes from becoming closed by adhesions as they healed. In the small number of cases followed the results have not been encouraging. In three cases the tubes were patent after operation but gradually closed as shown by subsequent examinations.

It has been of considerable interest to follow the sterility patients who had been insufflated to see if conception would result, from opening obstructed tubes. Nine persons who were insufflated, subsequently became pregnant. Other pregnancies may have occurred in cases which we have been unable to follow. The histories of the cases which became pregnant may be briefly summarized as follows:

1. Mrs. A. K., No. 22866. Age twenty-nine, married three years. Never pregnant. Dysmenorrhoea. Anteflexed uterus and endocervicitis. Date of insufflation, August 10, 1921, maximum pressure, 115 mm. Last period before pregnancy Octo-

ber 17, 1921. Last visit to the clinic, February 16, 1922, then four months pregnant.

2. Mrs. A. L., No. 27979. Age twenty-one, married six years. Never pregnant. Leucorrhea, marked endocervicitis. Date of insufflation, May 4, 1921. Maximum pressure 104 mm. Operation May 9, 1921, tracheloplasty, Sturmdorf. Pregnant three months after operation. Examined nine months after operation. Uterus was then the size of six months pregnancy, fetal heart heard.

3. Mrs. E. L., No. 27227. Age twenty-five years. Married four years. Never pregnant. Pain in both lower quadrants. Operation February 4, 1921, appendectomy, separation of peritoneal adhesions. Date of insufflation December 28, 1921. Maximum pressure with each of first two trials, 250 mm. Gas passed into the abdomen at 180 mm. with the third trial. Last menstruation May 15, 1922. Patient last seen in clinic September 27, 1922. She was then four months pregnant.

4. Mrs. M. M., No. 27599. Age thirty-two. Married eight years. Had had five induced abortions, the last three years ago. Complaints, sterility and leucorrhea. Endocervicitis. Operations, March 17, 1921, tracheloplasty, Sturmdorf. March 13, 1922, dilatation and curettage; resection of tube, right; removal of parovarian cyst, right. Date of insufflation September 1, 1921. Maximum pressure 120 mm. Patient was referred to the Obstetrical Department, January 10, 1923, four months pregnant.

5. Mrs. C. S., (Private Case), Age thirty. Married eight years. One full term child delivered by forceps one year after marriage. Complaint, sterility. Laceration of cervix and right adnexal disease. Date of insufflation May 4, 1921. Maximum pressure 178 mm. Patient became pregnant after next menstrual period and has since been delivered.

6. Mrs. D. S., No. 25965. Age twenty-six. Married eight years. One full term child one year after marriage. Complaints, sterility, backache, leucorrhoea, pain in lower abdomen. Operation June 26, 1920, plastic on cervix and pelvic floor; resection of left tube; separation of adhesions; appendectomy; operation for retroversion (Simpson). Date of insufflation December 21, 1921. Maximum pressure 190 mm. Patient was examined and found five and a half months pregnant on September 20, 1922.

7. Mrs. E. C., No. 24683. Age twenty-two. Married six years. One full term child one year after marriage. Complaints, sterility, dysmenorrhoea and backache. Laceration of cervix and bilateral salpingitis. Date of insufflation December 7, 1922. Maximum pressure 160 mm. Operation January 26, 1922, dilatation and curettage. Patient is now eight months pregnant and will be delivered in the hospital this month.

8. Mrs. G. C., (Private Patient). Age twenty-eight years. Married four years. Never pregnant. Insufflation maximum pressure 110 mm. Patient became pregnant two months after insufflation and is to be delivered in the hospital about January 15, 1923.

9. Mrs. L. B., (Private Patient). Age twenty-eight years. Married six months. Never pregnant. Date of insufflation December 17, 1921. Maximum pressure 70 mm. Husband normal. Patient became pregnant one month after insufflation and has since been delivered of twins.

From the histories of these cases it is very difficult to determine whether we can credit the method with any of the pregnancies which have occurred. Certainly the method had a therapeutic value in only a very small percentage of cases.

A study of the Rubin method was undertaken to determine whether it was a safe, practical diagnostic procedure. When patients were being

routinely examined with the fluoroscope, fainting occurred in several cases. One patient who was a chronic epileptic developed a seizure of short duration immediately following insufflation. The fact that 600 cases have been examined without any serious casualty proves that the method is reasonably safe. The technic of the test is simple. The discomfort to the patient is not great when the examination is carefully done.

CONCLUSIONS

1. The Rubin method for the determination of tubal patency is a simple, safe, diagnostic procedure.

2. If details in technic are carefully controlled we can form a definite opinion as to the condition of the tubes in approximately 85 per cent of the cases examined.

3. Patients should not be examined when near a menstrual period or in the presence of acute pelvic inflammatory disease or serious organic heart disease.

4. All cases of sterility, in which a definite diagnosis of the cause cannot be made by bimanual pelvic examination, should be insufflated.

5. Conditions which accompany menstruation, uterine displacements, ovarian and uterine tumors may cause partial or complete tubal obstruction and yet not be apparent to inspection at operation.

6. The method is almost entirely diagnostic. Pregnancy follows insufflation in only a very small percentage of cases.

7. Operative procedures which are done to open tubes or to keep them open in cases where both tubes have been involved in an inflammatory process, fail in a very high percentage of cases.

I wish to acknowledge my indebtedness to Dr. George Gray Ward, Chief Surgeon of the Woman's Hospital, for the opportunity to establish a clinic for the study of these cases.

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RENAL INFECTIONS COMPLICATING PREGNANCY*

By Henry G. Bugbee, M.D., F.A.C.S.
(Urologist)

IF every obstetrician would look upon the pregnant woman possessing two kidneys in the light of an individual having but one kidney and observe the same care in the study of the patient and especially of the kidney function as he would exercise in the case of pregnancy after nephrectomy, renal infections during pregnancy would be of less frequent occurrence, milder in their course, and the patient would receive better attention subsequent to the pregnancy.

The timely paper by Matthews,[1] "Pregnancy After Nephrectomy," shows what proper supervision will do in conserving the single kidney during pregnancy, and the same should be applied to women harboring two kidneys.

In a recent presentation Hinman[2] has convincingly shown the remarkable power of compensation of one kidney during the disability or after removal of its fellow. We have repeatedly noted, with little short of amazement, the subsequent recovering of a kidney to a useful organ, when it had apparently been destroyed by infection not only beyond repair but to the extent of being a menace to the system, after the factors entering into the causation of the infection were removed.

That nephrectomy is performed more frequently today than formerly is due to the fact that renal lesions are diagnosed correctly and earlier, due to accurate methods of diagnosis and not to promiscuous operating.

Nephrectomy for tuberculosis, new growth, some cases of pyonephrosis and occasionally for nephrolithiasis, hydronephrosis, or a rare lesion, is carried out at a stage when a local cure and the preservation of the general health is possible, but the removal of a kidney for infections, even of the fulminating type of pyelonephritis, is extremely rare, owing to a better understanding of the causation and treatment of kidney infections.

Incident to infectious diseases as typhoid fever, for example, and in the presence of infectious foci in the body, living bacteria may pass through the kidneys in appreciable numbers without giving rise to kidney infection. In this connection the virulence of the organism must be considered as well as the numbers, and on the other hand, the ability of the kidney to eliminate the bacteria from its pelvis and calyces by satisfactory drainage are the important factors.

There is an abundance of evidence collected from scientific experimentation and clinical study to show that renal infections are primarily

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hematogenous in origin—namely, that the organisms are supplied from the blood stream. That ascending infections are possible and probably do rarely occur; also the possibility of infection by lymphatic extension are beyond the limits of this paper.

That women are more prone to kidney infections than men must be accepted from reliable clinical reports, the percentage varying at from sixty to seventy per cent of all kidney infections. Such predisposing causes as pregnancy, menstruation, constipation, movable kidney, prolapse of the pelvic floor and splanchnoptosis being the most prominent contributing factors to this disproportion in the sexes.

As Matthews has stated, most obstetricians are agreed (1) that pregnancy is a pathologic process; and (2) that there is an increased load thrown upon the kidneys during pregnancy and labor. Thus, in the light of our present knowledge of the cause of kidney infections, the preponderance of infections in women, and the increased kidney strain incident to pregnancy, should not every effort be made to prevent such an infection?

Every case of pregnancy should be looked upon as in one sense a urologic case. As such, a careful history is in order. Information relative to the possibility of focal infections, of poor gastrointestinal function and urinary symptoms, should be especially solicited. A physical examination should be just as complete. The condition of teeth, tonsils and sinuses are of the utmost importance. Recent investigations carried out at the Mayo Clinic and reported by Bumpus, clearly show the close association between infection of the teeth, devitalized as well as abscessed, with infections of the urinary tract. It is impossible to go into the researches reported in his paper, but they are convincing. While bacteria from such a source may be eliminated by the kidneys under conditions of good body resistance, the lowered vitality and added kidney strain of pregnancy may be the deciding factor in starting an infection.

If discovered early in pregnancy the clearing up of focal infections may be possible, or the discovery of such processes will place one more on his guard to prevent or combat kidney infections in the first stages.

The discovery of enlarged lymph nodes or pulmonary foci is important. I have in several instances seen a pulmonary lesion become active during pregnancy and a renal tuberculosis result. By abdominal palpation much information may be gained. The presence of a tumor, enlargement or abnormal mobility of the kidneys and the tone of the abdominal muscles is important.

The patient with a flaccid abdominal wall and splanchnoptosis is more prone to poor gastrointestinal function, especially constipation; greater numbers of colon bacilli will be thrown into the blood stream to filter through the congested, poorly drained, prolapsed kidneys, and greater care must be exercised to prevent infection.

How much may be accomplished in such cases by abdominal support, moderate exercise, a carefully regulated diet, flushing the system with water, increased activity of the bowels and occasional colonic irrigations.

A sterile, catheterized specimen of urine should be taken as soon as the diagnosis of pregnancy is made. If bacteria or pus are found in such a specimen, not only should a roentgenogram of the urinary tract be made but a cystoscopic examination and a more careful search made for possible foci of infection, also elimination from the gastrointestinal tract should be promoted. A sterile specimen should be examined regularly throughout the pregnancy.

The time for making a diagnosis of the urologic condition in a case of pregnancy is when the history or physical examination of the patient reveals evidence of previous or present trouble and not, as is usual, when an acute infection is present, the patient then being as a rule acutely ill, when one's efforts must be directed toward relieving the severe symptoms usually present and carrying the patient through the pregnancy with as little interference as possible.

Renal infections during pregnancy most often occur between the third and seventh month. The acute attack is often preceded by a period of vesical irritability during which time the kidney is draining at least intermittently. This is the time when the proper treatment would in many cases prevent further trouble. The frequent burning urination is often passed off as due to pressure upon the bladder, when in reality it is due to a bacteriuria. The bacteria cause congestion of the urethra and trigone, also of the mucous membrane of the ureter through which they pass. Congestion at a point of angulation, such angulation due to prolapse of the kidneys, pressure from the uterus, possible stricture or torsion of the ureter from traction due to elevation of the pelvic contents, leads to complete obstruction of the ureter with cessation of bladder irritability and appearance of the local and constitutional symptoms of an acute pyelonephritis.

In some cases the ureteral obstruction takes place at once, in which case bladder symptoms are not present until drainage from the kidney has been reestablished. In such cases the first symptom is pain in the flank, associated with a rapid rise of temperature often to 105°, accompanied by extreme prostration and vomiting.

While in some cases of acute pyelonephritis it may be inadvisable to catheterize the ureters at once, but to delay instrumentation until the acute symptoms have subsided from internal medication before employing pelvic lavage, in pregnancy, I have seen no deleterious effects from intervention, and often the result is immediate and most striking. The pain in the flank is usually relieved at once when the catheter enters the dilated ureter or kidney pelvis and a temperature of 105° may drop to normal in a few hours. Such a condition is often not maintained,

however, for fluctuations of temperature are apt to persist for from three days to two weeks or more, due to intermittent drainage, and subsequent relapses are not uncommon.

The retention of a ureteral catheter in position is often a valuable aid in maintaining drainage.

In passing the catheter to the kidneys in cases of acute pyelonephritis of pregnancy, more or less obstruction is usually encountered in the first 10 cm. of the ureter. After passing the pelvic brim there is often a rapid flow of urine from the catheter. In cases of fatal eclampsia the ureters have been found to be in a state of acute dilatation from the bladder wall upward. Kidd believes this to be a physiologic dilatation of the musculature of the ureters set up by the chemical bodies or poisons circulating in the blood of pregnant women. Others maintain that pressure upon the ureter or torsion of the ureter causes the obstruction. The maintenance of kidney drainage, flushing the system with large quantities of water, promoting free elimination from the bowels and the administration of alkalis or urinary antiseptics are the immediate indications. When the acute symptoms have subsided occasional pelvic lavage during the pregnancy may be of great value in carrying the patient to term.

If a renal lesion has been brought to light by the superimposed infection, such as tumor, calculus, hydronephrosis, cystic degeneration, anomaly or malposition, seldom is it necessary to deal with such a condition until after the delivery. A renal lesion should receive treatment during and after the puerperium until cured.

Summary.—In the light of our present knowledge of renal infections, the frequency of such infections in women and especially during pregnancy, a careful study of the patient should be made to detect if possible any abnormality of the urinary tract which might predispose to infection, or the presence of a latent infection at the outset of pregnancy; also a thorough physical examination should be carried out with particular attention to the discovery of focal infections. Constipation should be properly corrected and sterile specimens of urine examined regularly during pregnancy; that first, kidney infections may be averted; secondly, that they may be detected early and corrected by removing the source of infection. If acute pyelonephritis does supervene, relief should be given by establishing drainage, flushing the body, increasing body elimination and treating the patient symptomatically until relief of the pregnancy, following which the patient should be treated until cured of the kidney lesion.

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PROPHYLACTIC BLOOD TRANSFUSION AS A ROUTINE MEASURE IN POOR OPERATIVE RISKS*

By George Gray Ward, M.D., F.A.C.S.
(Chief Surgeon)

BLOOD transfusion is today a familiar procedure in every hospital, thanks to the work of Crile, Moss, Linderman, Lewisohn, Unger and many others, who have simplified and perfected the technic so that it is now a comparatively safe and most valuable therapeutic measure.

The procedure is also familiar to the laity due to the frequent exploitation by the daily press of such good news copy as the "heroism" displayed by a relative or friend in sacrificing their blood to save one dear to them.

But to some of the profession and to the lay mind certainly, blood transfusion is still regarded as a measure of resort in desperate cases only, such as severe anemias and profound postoperative shock from hemorrhage.

I wish to call attention to the great value of blood transfusion as a prophylactic preparatory measure in patients who are to undergo any severe or prolonged operation, where shock or considerable loss of blood may be anticipated, and also in patients who are to have minor operations involving blood loss and who have a lowered resistance, due to anemia or other causes.

Gynecologic patients more than any others are most likely to have an associated secondary anemia of varying degree, due, of course, to the menorrhagias or metrorrhagias so frequently present in uterine or adnexal disease. Thus, in the Woman's Hospital in New York, we perhaps see a larger proportion of patients with anemia who have to undergo operation than is usual in a general hospital. The cases with fibroids, carcinoma uteri, idiopathic uterine bleeding, the incomplete abortions and ectopics are all most likely to have an associated secondary anemia of varying degree. Many such cases are dangerous operative risks, yet until recently it has been customary to operate upon such patients, often with an hemoglobin of 50 per cent or less, and a marked loss of erythrocytes, with an inevitable higher mortality rate than is necessary, although a blood transfusion may be done after the operation as a last resort when the grave condition of the patient is realized. Indeed, I am under the impression that today such is the usual practice in many of our hospitals.

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Furthermore, our conception of the amount of blood lost in the course of an operation is in general very vague. This has been recently pointed out by Gatch and Little[1] of Indianapolis in a study they have made of this subject.

LOSS WITHOUT BAD EFFECTS

Our idea as to the amount of blood a healthy individual can lose without marked inconvenience is based on our observation of blood donors. In our experience 500 c.c. to 750 c.c. is the average amount of blood that can be taken without symptoms, and that over that limit distressing signs begin to occur. The giving up of 500 c.c. of blood by an ordinarily robust individual certainly calls for no "heroism," and our internes are frequently glad to earn some extra money in this way.

Laboratory experiments confirm these observations as it has been shown that animals can lose 25 per cent by volume without bad effects. Gatch's and Little's observations approximate our own experience in this regard. Their method of determining the blood lost at operation was based on colorimetric measurements of the blood recovered by washing the gauze sponges used. Their results showed that the method was accurate within 5 per cent.

A panhysterectomy for fibroids showed a loss of 304 c.c., a radical breast amputation in a vascular case showed a loss of 710 c.c., a nephrectomy showed 816 c.c. It is easy to see that the loss of such amounts during operation in a patient with an hemoglobin of say 50 per cent and with less than 3,000,000 red cells, may seriously endanger the patient's life. Especially is this true when we consider that such a patient's resistance may be still further lowered by the added shock to the sympathetic system of a severe or prolonged abdominal operation. Likewise, in extensive vaginal plastic operations, there is nearly always a continuous capillary oozing of blood, which amounts to considerable loss in an operation requiring an hour or more for its completion, and which owing to its insidiousness, is frequently not fully appreciated by the operator.

Our experience at the Woman's Hospital in a considerable number of cases shows us that 500 c.c. of blood as a prophylactic preparation for operation in cases of secondary anemia is sufficient in the majority of the patients to bring the blood condition up to safety limits. Occasionally a second, or even third transfusion may be necessary in very low blood states, but we find this unusual. Undoubtedly this is due to the stimulating effect on the blood making organs that a transfusion produces as evidenced by the progressive improvement in the blood state that continues for some time after the transfusion.

This fact is fortunate as it makes the obtaining of donors much less difficult, if not more than 500 c.c. are taken, and with a donor available there is no excuse for not bringing our patient to the operating room with

her resistance at the best possible state in order to withstand the ordeal to be undergone with the maximum of safety.

All that is necessary then is the ability to perform the transfusion. Thanks to the work of Lewisohn anyone with the knowledge of the simple technic of an intravenous infusion can give a blood transfusion by the citrate method which is familiar to you all.

USE OF DIRECT METHOD

At the Woman's Hospital we use the direct method, as we believe its advantages make it well worth while, although formerly the citrate method was used. The technic we employ is that of Unger,[2] which has proved very satisfactory in our hands. Our internes are all trained in the technic, and in the past two years no interne has graduated from the hospital who is not an expert in giving a direct transfusion, and in typing and matching the donor and recipient's blood.

I have recently reviewed the blood transfusions done at the Woman's Hospital during the past two years by the direct method, and I have also had a study made of the reactions in this series by two Senior Cornell students (Souter and Duryea) during their course at the hospital, which will be shortly published.

In spite of the perfected technic and the more accurate methods of typing, posttransfusion reactions occur in about 25 per cent of cases, but fortunately the danger of gross incompatibilities may be said to be eliminated, and the reactions observed are usually not of a severe type, and are not sufficient to counteract the great therapeutic advantage of the transfusion. Still we cannot feel that the technic of blood transfusion is perfected until we can eliminate reactions in all cases. The cause of these reactions is still obscure and we cannot foretell when a reaction will or will not occur. As yet the problem has only been solved in its grosser aspects. The experimental work of Guthrie, Huck, and Pessel[3] has shown that it is probably necessary to modify the accepted classifications of the blood types of Jansky and Moss as they have demonstrated five isoagglutinins and isoagglutinogens in human blood. It is probable that the skill and dexterity of the operator in making a speedy transference of blood is a factor of considerable importance.

Our method is to use the Moss classification and the hanging drop method in the typing, and in addition, the blood specimen of both donor and recipient are directly matched in all cases for at least thirty minutes. We regard this last step as of the utmost importance in checking up on the compatibility. We also consider it very necessary that the donor's blood state be checked up at the time of the transfusion as it has occasionally happened that the donor has had an unsuspected secondary anemia. This is especially so if a professional donor is being used, and

will of course give a disappointing result. Many patients will be saved if every case is typed as a routine and a list of donors kept available for emergency use.

REACTIONS FROM LARGE AMOUNTS

Our study seems to show that transfusions of more than 500 c.c. of blood were followed with a higher percentage of reactions than with the smaller amounts, and repeated transfusions increased the percentage of reactions. We do not find that a transfusion increases the blood pressure to any marked extent, and therefore do not hesitate to give a preoperative blood transfusion in cases of internal hemorrhage such as in ectopics, as we do not fear further bleeding from increased pressure. We have also observed that at the end of forty-eight hours the highest percentage of increase of hemoglobin and red cells occurred in those patients who had had reactions.

It is our practice in cases of profound operative shock to give immediately an intravenous infusion of 250-300 c.c. 6 per cent gum acacia and 20 per cent glucose solution at a rate of 4 c.c. per minute at a temperature of 105° F. as advocated by Farrar,[4] which will at once raise the blood pressure and hold it for several hours, thus combating the state of shock until the blood transfusion can be given. This we find is a safe and most valuable aid in an experience of many hundreds of such infusions.

We now have accurate records of 282 direct blood transfusions done on the gynecologic service of the Woman's Hospital during the past twenty-six months, which record the temperature, blood pressure, pulse, and complete blood examination before, directly after, two hours after, and forty-eight hours after the transfusion, in addition to the general facts concerning donor and recipient. Prior to that time, the records did not give complete details, the methods were variable and the technic was not standardized, and the transfusion was in general use only as a resort in desperate cases. Of these 282 transfusions, more than 50 per cent were preoperative prophylactic transfusions, done to bring the patient to the operation with her maximum of resistance, and in addition a considerable number were done at the time of the operation or immediately after as a prophylactic measure and not because of the precarious condition of the patient. And I wish to emphasize the point that in many of these cases, the patients were *not* in a state of marked secondary anemia but showed a moderate loss only, as for example 65-70 per cent hemoglobin and 3,000,000-3,500,000 red cells. That this preparatory treatment was well worth while, is unquestionable, our mortality and morbidity being reduced and the beneficial results, as shown by a much speedier and smoother convalescence, are acknowledged by the entire staff. I feel sure that the adoption of *routine* preoperative blood transfusions in patients, whose resistance has been lowered, or whose blood examination shows a

reduction under 75 per cent, will reduce the operative mortality rate of any hospital as it has ours, which last year was 1.6 per cent for all cases.

One of the great benefits that has come out of the Hospital Standardization movement, which was first stimulated by Codman, is that today we give careful preoperative study to our patients. The light of the Staff Conference beats too strongly on our after results to allow of the railroading of the patient to operation when no emergency exists. Thus, with a better knowledge of our patient's condition we have no excuse for not giving her the advantage of this valuable prophylactic measure, should her resistance and blood state require it.

SUMMARY

In conclusion I would emphasize the following:

1. The blood transfusion should be employed as a *routine* prophylactic measure before operation much more frequently than is the present practice, especially in gynecologic cases.

2. That every interne on graduation from a hospital should be competent to make the necessary blood typing and blood matching technic, and to perform a blood transfusion, preferably by the direct method. The blood examination is often necessary at night or on holidays when the laboratory force is not available. This implies definite instruction and the skill which comes with practice.

3. That 500 c.c. of blood is sufficient in a large proportion of cases for a prophylactic transfusion, and that this amount is not sufficient to cause the donor distress.

4. That the amount of blood lost in many gynecologic operations is not always appreciated by the operator and is a factor that should be considered where patients have a lowered blood state.

5. That while posttransfusion reactions occur in about 25 per cent of cases they are usually not of a serious type provided that the donor's and recipient's blood have been directly matched, and that they do not appear to mitigate the benefits of the transfusion.

6. That if this procedure is more generally adopted, it will result in an appreciable improvement in our mortality and morbidity statistics.

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HYPEREMESIS GRAVIDARUM TREATED WITH BLOOD TRANSFUSION

By Dougal Bissell, M.D., F.A.C.S.
(Attending Surgeon)

Case 1.—Mrs. C., aged nineteen, became pregnant about July 15, 1923, during her first month of married life. She was first seen by me Aug. 1, 1923. Her weight was 160 pounds, height 5 feet 9 inches; appetite good, neither nausea nor vomiting. The uterus was completely retroverted; corpus was replaced and held in position by a well-fitted Emmet pessary. Aug. 14, uterus was in normal position but since last seen she had been nauseated every day with occasional vomiting. On Aug. 29, the patient reported that nausea and vomiting were persistent. She was allowed to leave the city on a visit of a few days during which time there was very little nausea and no vomiting. Returning home by water she encountered a severe storm and became very seasick. Vomiting recurred and was persistent. On Sept. 6, the corpus was again retroposed. The pessary was removed, corpus again replaced and held in position by cotton tampons. This treatment was continued until Sept. 28, when it was discontinued for a time because of considerable blood being found on the tampons. From Sept. 10, to Sept. 28, the patient was kept in bed on a dry diet and during the latter part of September there was less nausea and vomiting. On Oct. 2, the uterus was in a very low position and the muscles of the vaginal outlet greatly relaxed—cotton tampons were again resorted to but discontinued after one week because of a bloody discharge. Although vomiting was not quite so persistent, the patient had lost 50 pounds. Urine at no time showed kidney pathology, blood examination Oct. 10, showed a decided diminution in the number of red corpuscles with a somewhat low leucocyte count and a normal differential count. Hemoglobin 50 per cent.

On Oct. 12, 1924, transfusion was suggested by me and in consultation with F. A. Dorman and R. W. Lobenstine it was agreed that 250 c.c. of blood be given. Hope was entertained that vomiting would be lessened by this treatment but complete cessation of it was not expected, the chief purpose was to improve the patient's general condition.

The patient was admitted to the hospital Oct. 12, 1924, temperature 99.2°, pulse 96, and persistent pain in the lower abdomen. On Oct. 13, blood chemistry examination showed CO_2, 48; blood urea nitrogen, 10.5 mg.; blood sugar 0.11 per cent; Group II; Hemoglobin 45 per cent; blood pressure 112/68. During the morning of this day, patient vomited a number of times and complained of feeling very tired. Just before transfusion, she was given a little minced chicken, toast, and tea. At 2 P.M., 250 c.c. of blood were given by the Unger method. The patient rested comfortably until 8 P. M. when she became nauseated but did not vomit. Bromide of soda, 40 gr. and chloral hydrate, 20 gr. were given per rectum. Patient had a comfortable night. No reaction followed transfusion.

On Oct. 14, she retained roast beef, toast, asparagus, minced chicken, rolls and tea. This diet with slight variation was continued each day. At no time after transfusion did she vomit food. Three days following transfusion the blood showed marked improvement, hemoglobin 65 per cent. Before transfusion the patient was mentally depressed but within twenty-four hours after transfusion there occurred a marked change in this respect.

The patient was delivered of a normal child about two weeks before the expected time of labor.

Case 2.—Mrs. B., aged thirty-one, married thirteen years, had one child eleven years old. Last menstruation, May 2-5, 1924. She was first seen by me July 25, 1924. Since May 30, she had vomited after every meal and often between meals; during the past seven weeks she had lost 10 pounds; occasional headaches, very nervous, did not sleep well, had occasional constipation and at times resorted to cathartics and enemas. The patient was advised to rest in bed and was given a limited dry diet for ten days, without relief. She was then sent to the hospital. Again a limited dry diet treatment was followed for eight days, but emesis persisted. Hypodermatoclysis was administered once. Glucose, 5 per cent, and soda, 2 per cent (6 oz.) per rectum on three occasions. Murphy drip was attempted several times but was unsuccessful because of the loss of sphincter tone. Urine and blood were normal. Each day, however, she was losing ground physically and her mental depression was becoming a serious problem. As the blood was normal in this case, no thought was given to the idea of transfusion when she was sent to the hospital, but when it was found that relief was not afforded by rest and diet under close observation and treatment, transfusion was resorted to empirically. On Aug. 12, she was given 250 c.c. of her husband's blood; both belonged to Group IV. No reaction followed; on the following day she vomited three times but slept well that night and felt greatly improved mentally the following morning.

From this date on she ate heartily and only once vomited her food. On two other occasions slight emesis occurred but at times when the stomach was without food. The most striking change following the transfusion was in the mental attitude of the patient, for within twenty-four hours her depression had ceased, she smiled for the first time in months and though occasional vomiting occurred as noted, she was not in the least discouraged. She was last seen Oct. 8. No vomiting had occurred since leaving the hospital and she is in the best of health mentally and physically. Labor expected Feb. 12, 1925.*

It will be noticed that in neither of these cases was there discovered pathology in any of the organs. The loss of flesh and physical strength and the poor blood picture were in addition to persistent vomiting, the outstanding features of the first case. In the second case we find comparatively little loss of flesh, great mental depression and no change from the normal blood picture.

*Patient delivered normally, February, 1925.

END-RESULTS AFTER OPERATIONS IN 53 CASES OF UTERINE PROLAPSE*

By Hermann Grad, M.D., F.A.C.S.
(Attending Surgeon)

THIS study of prolapsus uteri is based on 53 cases operated upon by myself during five years beginning 1915, many of which have been under observation over five years.

Passive and active causes for prolapsus uteri are described. Among the passive causes the following conditions are enumerated, which favor a descensus of the uterus: (a) faults in the perineum; (b) in the vaginal walls; (c) in the uterine ligaments; (d) in the cellular tissues; and (e) in the pelvis.

An intact female perineum with normal function, gives support to the female pelvic organs indirectly during moments of increased intraabdominal tension, such as coughing, sneezing and lifting. Muscular contraction of the perineum guards and supports the pelvic organs from undue tension. This function of the perineum is Nature's prophylactic measure against prolapsus uteri, although prolapsus occurs with intact perinei.

A lacerated perineum favors descent of the uterus, nevertheless a complete prolapse of the uterus with a complete tear of the perineum is quite rare.

Complete laceration of the perineum usually occurs during labor in those cases where there is a short transverse diameter of the pelvic outlet. The rami of the pubes in forming a less obtuse angle at the symphysis protects from injury the fascia of the anterior wall of the vagina and the fascial layer of the cardinal ligaments by the oncoming head of the baby. On the other hand, with a more obtuse angle of the rami of the pubes, the fetal head in labor traumatizes and lacerates the fascial support of the bladder and uterus and the occurrence of prolapsus uteri is favored.

To what extent the faulty conditions in the vaginal wall, cellular tissue, and pelvic bones favor the occurrence of a procidentia is more of an academic interest than practical value.

Faulty conditions in the uterine ligaments are the chief cause in the production of procidentia uteri. By uterine ligaments not only the round ligaments, the broad ligaments and the uterosacral ligaments are included but also those ligaments which include the pelvic fascia and the so-called cardinal ligaments. This leads not only to retroversion and retroflexion but to complete procidentia of the uterus and uterine adnexae

*Read at a meeting of the New York Obstetrical Society, Feb. 12, 1924.

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and is by far the most important condition to be considered in dealing with the subject of the etiology of the uterine prolapse.

Increased intraabdominal pressure is the most important active causative factor in procidentia uteri. Long continued downward pressure of the pelvic contents may so weaken the pelvic diaphragm as to cause herniation of the pelvic organs. We therefore find procidentia more frequently in the working woman, and more frequently in the parous than the nulliparous woman.

By far the greatest number of prolapsus uteri are acquired. Childbirth is the great etiologic factor in causing uterine prolapse. With the uterine support gone, herniation of the female pelvic contents results. The degree of prolapse will depend upon the degree of destruction, which, of course, must necessarily vary with each individual case, because the forces operative in each labor must of necessity also vary. In some cases the initial prolapse occurs along the plane of the urinary bladder, as a result of a destruction of the fascial plane that gives support to the bladder. A cystocele develops first, as this viscus descends, it draws downwards other pelvic organs along their planes. In other cases the uterus retroverts and the cervix prolapses along its own plane and appears at the vulva. In still other cases at first a rectocele with a descensus of the cervix occurs. In a certain proportion of cases a herniation of all the female pelvic organs occurs, constituting the cases with a third degree of prolapsus uteri.

The 53 cases here reported have been divided into three classes:

1. Cases in which the prolapse developed after the first childbirth.
2. Cases in which the prolapse developed after two or more labors.
3. Cases in which the prolapse developed after the climacteric period.

Eleven cases, 21 per cent, had prolapse after one childbirth. The youngest was 23 and the oldest 55. There were as many cases that had instrumental deliveries as those that were delivered without any aid. In only one case was there a laceration through the sphincter ani, and in this case only a first degree of procidentia developed. This bears out the argument advanced before that when the sphincter tears, there is less injury sustained by the fascial layer under the bladder and cardinal ligaments and therefore procidentia is not so liable to develop. While the prolapse developed in the majority of these cases soon after the childbirth, in one case, No. 41, it did not occur until fifteen years later. This patient had well-developed ligaments, and had a complete prolapse at the age of 38.

In three of these eleven cases the ligaments were very poorly developed. It is probable that congenital prolapsus would have developed in these three cases even if they had not passed through childbirth. In one of these cases a second degree of prolapse developed six months after a normal labor. In the second case the prolapse went to the third degree and developed five months after an instrumental delivery. In the third

case there was also an instrumental delivery but the prolapse developed only after two years.

In 21 cases, 39 per cent, the prolapse developed after two or more children, nine cases were instrumental and ten noninstrumental deliveries. (In two cases character of delivery was not stated.) It is a question to what extent instrumental deliveries are causative factors in procidentia uteri. In my total number of cases, 30 out of 51, or 59 per cent, had normal deliveries. The pelvic fascia, cardinal ligaments, in fact all of the supports of the female pelvic organs may suffer just as much injury or even destruction in a normal labor as during a forceps delivery. In fact a well-conducted forceps operation should result in very little, if any injury to the supports of the pelvic organs.

In 21 cases (39 per cent) prolapse developed after the climacteric period. The youngest patient in this series was forty and the oldest sixty years of age. Uterine prolapse, according to this report develops after the climacteric period just as frequently as during the childbearing period of life. On theoretical grounds prolapse should develop less frequently, because the tissues have involuted, there is less weight to the organs to be supported, and the tissues are less liable to yield to pressure. However, this is not the case judging from the above. In two cases Nos. 12 and 48, the prolapse developed after the twelfth childbirth and in another case No. 5, the prolapse developed after the eleventh labor; in still another case, No. 53, after the ninth and in two cases, Nos. 31 and 52, after the eighth.

The various points brought out by the study of the 53 cases of prolapse here reported, are as follows:

1. That prolapse develops in 21 per cent of cases after the first childbirth, and that 72 per cent of the prolapse is of the third degree.

2. That in 39 per cent of cases the prolapse comes on after two or more children are born and that 71 per cent of the prolapse is of the third degree.

3. That prolapse develops during the climacteric period just as frequently as during the active childbearing period in 39 per cent of cases and that 76 per cent of the prolapse is of the third degree.

4. That instrumental deliveries appear to have no bearing on the cause of uterine prolapse as statistics show that there were as many prolapses in the noninstrumental deliveries as in the forceps deliveries.

The complications in the 53 cases were as follows: 5 had fibroids of the uterus, 3 ovarian cysts, 1 salpingitis, 3 hernias (one inguinal and two ventral), 1 rectovaginal fistula, 1 hemorrhoids, 1 retained secundines, and 1 myometritis.

There were 236 pathologic lesions in the 53 cases operated upon.

There were 216 operations performed in 53 cases. In 35 cases the cervix was amputated; 23 cases had the uterus interposed; 42 had an anterior colporrhaphy performed. The perineum was repaired in 50

cases although the records show that a laceration of the perineum was recorded in only 45 cases. I consider perineorrhaphy an essential step in every operation for procidentia. While the perineum does not give support to the uterus *per se*, it sustains the pelvic organs during moments of increased intraabdominal pressure. In 22 cases the uterosacral ligaments were shortened by a special method to be described later. Seven cases had a vaginal hysterectomy performed. In one case the abdomen had to be opened on account of uncontrollable hemorrhage from an anterior colporrhaphy.

The results of the operations on the 53 cases of procidentia were as follows: 27 cases were successful (75 per cent); 6 cases were partially successful (17 per cent); 2 cases died (3.7 per cent); 17 cases were not heard from. If the 6 cases of partial successes are included among the successful ones there are 97 per cent of successful operations. To thus include the partially successful cases with the successful ones is permissible because the procidentia was cured in every one of these cases and only part of the various operations performed were unsuccessful. Under these conditions the percentage of successful cases was 92.

Interposition was done 23 times, mostly on cases of procidentia developing after the climacteric period. It is an operation appropriately designed for this class of cases. There was one death in these 23 cases. Interposition is not a time-consuming operation and therefore lends itself to those cases of prolapse where a prolonged operation is not to be undertaken on account of the general condition of the patient. In the postclimacteric procidentia cases the uterus is small, having undergone involution, and therefore the organ adapts itself to the operation. Some of my most grateful patients are old women who have been relieved of their procidentia by this simple but safe operation.

In three cases interposition was done in young women, Nos. 16, 18 and 23. These three patients were still in the childbearing periods and the operation was chosen because it appeared to be best suited. In two, both tubes were also resected to insure sterility. In Case 23 the tubes were not resected, because the patient took the anesthesia very poorly and the operation had to be ended as quickly as possible. This patient had a stormy recovery but has remained well and cured of her procidentia. She has been under observation for five years.

In the 23 cases of interposition, 19 were entirely successful, the procidentia was relieved and the patients were entirely satisfied. Two cases are put down as partially satisfactory because they were not, strictly speaking, successes in every way. In one case the rectocele recurred and in one case the anterior wall of the vagina was shortened. Nevertheless in both of these cases the procidentia was relieved. One case died of gangrene of the left leg, a very rare complication, and strictly speaking it should not be charged up against the operation.

In four cases the prolapse was of the first degree only. In addition

to the interposition, the uterosacral ligaments were also shortened by the vaginal route. In the light of experience it was unnecessary to burden the patient with this additional operation. The cases that were subjected to the interposition alone fared as well as those with shortening of the uterosacral ligaments. There were 2 cases with second degree prolapse and 17 cases with third degree of prolapse.

The end-results of the operation show that 9 cases were not heard from after the operation, leaving 14 cases to be accounted for. Eleven cases were entirely successful. Two cases were partially successful. Eleven cases out of 14 give 80 per cent of permanent cures, and as the 2 other cases of partial successes were also relieved of the prolapse, it is entirely permissible to say that 13 cases out of 14 were successful and therefore the percentage of cures was 93.

In two cases, Nos. 2 and 28, the rectocele recurred. In two, Nos. 26 and 41, the perineal operation was a failure and in two, Nos. 32 and 40, the anterior wall operation was a failure. In case No. 41 the perineum broke down after a childbirth subsequent to the operation.

One case, No. 33, was a failure. The cause of the failure was due to an error in surgical judgment. The circumstances were as follows: The patient had a complete prolapse, with eversion of the vaginal walls. The uterus had become pregnant in this prolapsed condition and the patient was suffering with an incomplete abortion. She had one child and was very anxious for a second. The patient also had a very tender appendix which required removal. Nothing short of a vaginal hysterectomy and utilization of the broad ligaments, for the support of the vaginal prolapse, should have been considered in this case. Instead of a vaginal hysterectomy, the following operation was done. The uterus was curetted to clear it of the retained secundines and a week later the plastic operation done as well as the laparotomy for the removal of an infected appendix. Four months later the uterus completely prolapsed again. Abdominal shortening of the ligaments does not and cannot give permanent support to a uterus and adnexae that are in a state of complete prolapse. Looking back on the case, I believe that the following procedure should have been adopted. The uterus should have been curetted and the appendix removed at one sitting and a vaginal hysterectomy with the necessary plastic operation done at the second sitting. This case was successfully operated upon by me on April 4, 1922. A vaginal hysterectomy and plastic operation were done seven years after the first operation.

There were two deaths in this series, Nos. 19 and 22. Case 19 died of gangrene of the left leg—a very rare complication. The case was a poor surgical risk and should not have been operated at all. She was incapacitated by a third degree of prolapse, a rapid operation was decided upon on account of her general poor condition. The uterus was interposed and the perineum repaired. She recovered from the operation, developed a phlebitis and died with gangrene of the left leg.

The second case, No. 22, died of general peritonitis following a hysterectomy and plastic operation, a purely unavoidable death. The case was a good surgical risk in every way. The patient was 55 years old and had a complete prolapse.

Out of 53 operated cases, only 34, or 64 per cent, could be traced. Fifteen cases were observed for a period of from one year to five years, and nineteen for from one to eleven months.

The statistics here given of the 53 cases of procidentia uteri were carefully compiled and honestly presented. Two operations utilized in these cases, amputation of cervix and vaginal shortening of the utero-sacral ligaments, are here described in detail.

AMPUTATION OF CERVIX

A circular incision is made around the cervix, at the junction of the normal mucous membrane of the vagina and the granulation tissue of the cervix or, where the mucous membrane joins the scar tissue of the laceration. The cervical tissue is laid bare of all mucous membrane, the large vessels severed are picked up individually

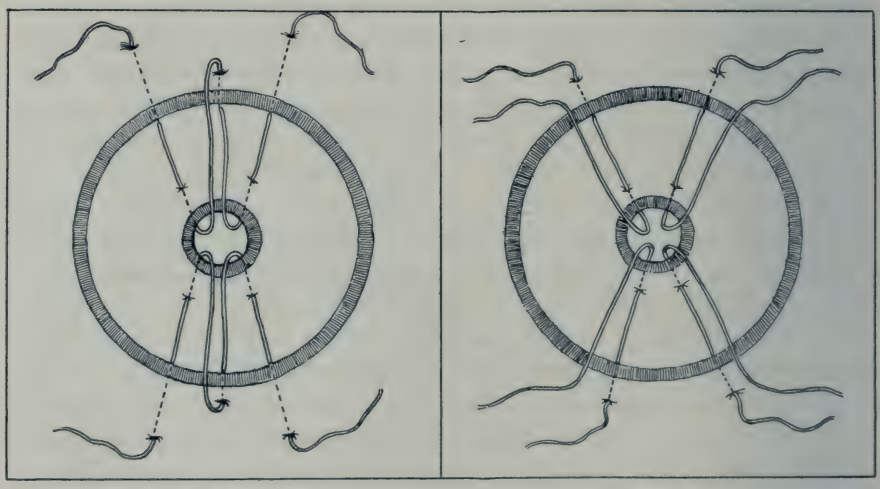

Fig. 1. Fig. 2.

Figs. 1 and 2.—Diagrammatic representation of amputated cervix, showing manner of inserting the primary sutures (Fig. 1) and the additional sutures (Fig. 2).

and tied. By laying bare the cervix of all its attachments a very good cuff of mucous membrane is obtained. The cervix is now cut across at the internal os or at a lower point, depending upon the operator's desire to amputate the cervix high up or lower down. The cervix having been amputated, the next step is to suture a flap of tissue of the mucous membrane of the vagina to the edge of the uterine canal to prevent stenosis. It is my practice to use six canal sutures, three above and three below.

In tying the sutures placed in the manner shown (Fig. 1) it is important to guard against strangulation of tissue by tight sutures. The loop pulls the vaginal mucous membrane into the canal of the uterus, but it should be tied so loosely that a space is left between the knot and the mucous membrane, sufficient to admit the point of an artery clamp. The other canal sutures will reinforce the loop of

the first canal suture sufficiently to hold it in place. Tissue constriction should be avoided in every possible way as it leads to necrosis of tissue and interferes with proper healing. Furthermore a cervix operation that heals by granulation is apt to leave a stenosis of the external os, and cause a great deal of scar formation. Necrosis of tissue due to tight sutures may cause secondary hemorrhages.

VAGINAL SHORTENING OF THE UTEROSACRAL LIGAMENTS

The fundus of the uterus is delivered into the vagina, as is done in the interposition operation. By pulling on the fundus uteri the uterosacral ligaments come into view and can be outlined. With a linen suture the edges of the uterosacral ligaments are picked up, about an inch and a half from their uterine insertion. A stab wound is now made beneath the broad ligament from the vagina into the peritoneal cavity, close to the cervix, on either side. Through these stab wounds are drawn the two linen sutures. It is to be noted that the linen suture in the right uterosacral ligament is brought out on the left side of the cervix and the suture in the left uterosacral ligament comes out on the right side of the cervix. The uterosacral ligaments are then drawn through the stab wound and sutured to the anterior surface of the cervix of the uterus. This procedure has the effect of pulling the cervix into the hollow of the sacrum. A very substantial support for the uterus is thus created. This operation was utilized in 24 of the cases here reported. The technic is comparatively easy. The ligament is not severed from the uterus as in the Jellet operation. Should the uterosacral ligaments be short and not reach around the cervix, they can be sutured to the side of the cervix with equal success.

From the study of these cases of prolapse here presented and from practical experiences in dealing with procidentia, in its various phases, the conclusion has been reached that the first and second degrees of prolapse require practically the same surgical procedures. In a small number of cases of first degree of prolapse an elongation of the cervix with retrodisplacement of the uterus is the only pathologic condition that needs surgical correction. While these cases are not strictly speaking procidentia cases, from the patient's point, they are, because they produce the same symptoms. In this class of cases, we are apt to do too much plastic work, and subject the patient to unnecessary traumatism and morbidity. An amputation of the cervix with a perineorrhaphy brings about a very satisfactory and permanent result.

In the cases with second degree of prolapse, more extensive plastic work is called for to bring permanent relief to the patient. In these cases, an amputation of the cervix and a plastic operation on the anterior wall of the vagina for the cure of the cystocele is of great importance, which is to be combined with perineorrhaphy.

In the third degree of prolapse the problem is an entirely different one. These prolapse cases must be carefully studied to arrive at a proper conclusion as to what type of operation is best suited for the particular case. Shall the operation be one of a plastic nature alone or shall a hysterectomy also be done, or should the patient have an interposition operation? These three types of operations call for discrimination and consideration as to the physical condition of the patient. The age of the patient and

social status are also of importance in the consideration of the type of operation to be advised for this particular case. Attention has already been called to the satisfactory results that were obtained with interposition in patients in the advanced period of life. In many cases nothing short of a vaginal hysterectomy will give results. A hysterectomy, however, has its morbidity and also its mortality, an important consideration in prolapsus uteri, as is shown in the statistics. Hysterectomy was performed seven times (13 per cent) in my series, and it is in these cases that a fatality occurred in a patient who was a very good surgical risk, and the operation was devoid of any technical difficulties. She stood the operation well and died of peritonitis. It was impossible to discover the source of the infection.

ANALYSIS OF OPERATIONS

Eight different operations were utilized to correct prolapse in my series. There were 27 operations performed in eight cases with first degree of prolapse, making an average of 3⅜ operations for one case. Twenty-one operations were done in six cases with second degree of prolapse, making an average of 3½ operations for each patient. The 39 cases with third degree of prolapse had 141 operations performed, making an average of 3⅝ operations for each case. In the total number of cases, 189 operations were done, an average of 3⅝ operations for each case of prolapse. Sixty-six per cent of the patients had the cervix amputated; 79 per cent had an anterior colporrhaphy; 94 per cent had perineorrhaphy; 43 per cent had interposition; 41 per cent had the uterosacral ligaments shortened; 13 per cent had vaginal hysterectomy.

The same type of operation was used in each one of the three degrees of prolapse. In the cases with first degree of prolapse the anterior wall was operated on in 37 per cent of cases, while in the cases with third degree of prolapse this same operation was done in 89 per cent of the cases. The same is true of perineorrhaphy. In the first degree of prolapse it was done in 87 per cent of cases, in the third degree in 97 per cent. Interposition was done in the cases with first degree of prolapse, in 50 per cent, 33 per cent in the second degree and 43 per cent with third degree.

CONCLUSIONS

From the study of the 53 cases of prolapsus uteri here presented the following conclusions are justified:

1. That childbirth is the cause of prolapsus uteri.
2. That in 21 per cent of cases the prolapsus develops after the first childbirth and that in 72 per cent the prolapse is of the third degree.
3. That in 39 per cent of the cases the prolapse came on after two or more children were born, and that 71 of the cases had a prolapse of the third degree.

4. That instrumental deliveries appear to have no bearing on the cause of uterine prolapse. There were 41 per cent of instrumental deliveries as against 59 per cent of noninstrumental deliveries.

5. With the advance of the age of the patient, there is a progressive increase in the percentage of the number of the third degree of prolapse.

6. Complications are fairly frequent in procidentia uteri.

7. Operations are successful in 75 per cent of cases.

8. There is a morbidity and a mortality rate to be considered by the surgeon in operating for procidentia uteri.

9. Interposition is a useful operation in all of the three degrees of prolapse.

10. The same type of operation was used in the various degrees of prolapse.

40 East Forty-first Street.

FETAL HYDROPS WITH ERYTHROBLASTOSIS

By Alfred Plaut, M.D.,
(Pathologist)
and Edward A. Bullard, M.D.
(Junior Attending Surgeon)

Mrs. N. A., aged twenty-six, married eight years, was a robust woman who had had only minor ailments.

Her first child was born seven years ago and observations during that pregnancy revealed no abnormality. The labor, though dry, was of only four hours duration and ended in a spontaneous easy delivery, by the family physician, of a male infant normal in every respect,—the weight not taken.

The second pregnancy occurred five years later (1922) and developed without incident. The labor was quite simple, ending after three hours in the delivery, by the family physician, of an eight and one-half pound male child, normal in every respect. A very slight icterus was noted next day but the child was lively and well. On the second day after delivery the jaundice was well developed but the baby did not appear ill. However, the following day, the baby became intensely jaundiced and grew very ill rapidly. The attending physician was unable to make a definite diagnosis but considered congenital obstruction of the bile ducts. A few hours later, in the absence of the family doctor, the child was seen by another physician. The baby was then in extremis; deeply jaundiced, with frothy bloody sputum in its mouth, and signs of congestion in the bases of the lungs; death followed in two hours. Autopsy not obtainable. The second physician was as puzzled as the first but felt that hemolytic jaundice and pneumonia must be considered.

The patients' third pregnancy began a few months later, and, as formerly, the monthly examination showed nothing abnormal. In August, 1923, from no apparent cause the patient went into labor two weeks before full term and after pains for only one hour delivered herself spontaneously of an eight pound female baby, just as the doctor arrived. This was a breech but a very easy expulsion and on examination the baby was found to be quite normal. This child continued normal to all appearances, was lively and nursed vigorously. On the fourth day, it became suddenly ill, vomited, went into collapse and died within an hour—before the physician arrived. Again autopsy was refused, and the family physician was at a loss to explain the cause of death.

In March, 1924, the fourth pregnancy began and the family physician referred the patient to Dr. Bullard for observation. She appeared to be a robust, vigorous, normal woman and general and pelvic examination discovered no abnormality whatever. She was examined every three weeks and the pregnancy progressed normally. Between the third month and delivery she had three attacks diagnosed as "Ménière's disease, classical and unmistakable." The medical attendant advised no special treatment for this during pregnancy.

Early in the seventh month the uterus appeared to be enlarging rapidly, edema of feet began, and patient felt very heavy and uncomfortable; constant nausea and insomnia became very troublesome. There were no ocular symptoms, no headaches, and blood pressure and urinalysis were normal. The blood picture was normal. The patient was put to bed, diet and fluids restricted and saline purges and sedatives given. One week of this accomplished nothing. The uterus was obviously larger, appearing to be at full term, fetal movements active but heart

never heard, edema of legs worse, but no headaches and urine and blood pressure continued normal.

This condition continued essentially the same until a few days later, Oct. 24, when labor began and the patient entered Woman's Hospital. The patient's pains were powerful and frequent and the cervix was fully dilated in four hours from the onset of labor. The membranes were now ruptured by a stylet but the vertex, deeply engaged in left occipitoposterior position after descent to midpelvis, would come no further and would not rotate. After forty-five minutes of the second stage the pains had become very feeble and progress was obviously at a standstill. Accordingly, under anesthesia midforceps was applied, anterior rotation of the occiput easily accomplished, and after reapplication the head was delivered. In this maneuver it was noted that there was plenty of room for the head but the body of the child seemed to be a very tight fit in the pelvis. Finally, the body of the baby was delivered but only by a combination of powerful traction from below and the hardest sort of pushing on the fundus by the interne. The baby appeared to have been dead several days. One c.c. of pituitrin was given hypodermatically and the delivery of the placenta was attempted. It was quite friable, ragged, and necrotic and came away in six pieces by persistent use of Credé's technic.

Patient reacted well and made an uneventful convalescence except for the expulsion of a bit of placenta on the nineteenth day accompanied by slight bleeding.

Autopsy Record

Path. No. 25948 Date: 10-24-24

Body of a male newborn 44 cm. long, weighing 8 pounds, with rigor mortis present in the whole body. Lanugo on back and shoulders. The whole body is extremely edematous. At the points where gauze bandages have been used to tie together the baby's wrists and ankles deep furrows are seen in the skin. A very deep furrow separates the edematous chin from the edematous chest wall and in its depth the skin is macerated. No neck is to be seen. The scrotum is edematous and hard, the penis has the thickness of a man's thumb with its distal part macerated. The eyes are surrounded by such a hard edema of skin that it is impossible even by drawing the eyelids apart to see the iris. The normal skin furrows at the internal side of the thighs are very deep. The consistency of the skin is as usual in edema. The ears are very much swollen and look like cauliflower ears.

The circumference of the abdomen is 40 cm. In opening the abdominal cavity a large amount, approximately 600 c.c., of water-like fluid escapes. The diaphragm on both sides is nearly at a level with the costal arch. The ribs look normal. Both pleural cavities are filled with water-like fluid; there is a slight admixture of blood which may be artificial. Both lungs are lying at the side of the spine, filling only the third part of the pleural cavities. The *thymus* is relatively small, edematous, and studded with small hemorrhages. The pericardial sac contains about 30 c.c. of water-like fluid. The *heart* is twice as large as the swollen fist of the baby. Its axis is much nearer to the horizontal than normal. It measures 6 by 5 cm. The botallian duct is closed. There are no anatomic anomalies in the heart and no signs of inflammation. The coronary arteries are normal. Under the epicardium, especially near the longitudinal anterior sulcus, many small hemorrhages are found.

Neither *lung* floats on water, nor do small parts of them. The cut surfaces are homogeneous and pink; the mucosa of the bronchi is very pale.

The mediastinum is extremely edematous, the tongue is pale and firm, the uvula is glassy and thick, and the aditus laryngis is completely closed by the heavy edema of aryepiglottic folds. The larynx and trachea are not opened in order to preserve the specimen of aryepiglottic edema.

The *spleen* measures 7.5 by 4.5 by 3.5 cm. Its surface is perfectly smooth, and it is firmer than normal. It is dark, cyanotic; the cut surface is homogeneous, purple and no follicles can be seen. The *suprarenals* are of normal size and contain no blood; the amount of fatty substances in their peripheral parts seems to be small.

Both ureters are normal. The *kidneys* peel easily out of their capsules; they measure 4 by 2 by 1.3 cm. Their cut surfaces are normal. The *bladder* is pale and has the normal oblong shape; there is a small hemorrhage above the left ureteral opening. The *testicles* are surrounded by yellow jelly-like edematous masses. The rectum and the sigmoid are filled with meconium while the other intestine is narrow and nearly empty. There are many large hemorrhages in the serosa of the *small intestine*. The mesentery is so stiff by the extensive edema that the convolutions of the intestine do not fall down corresponding to the gravitation. The *stomach* is normal; no edema is seen in its wall. The *pancreas* is normal. The *liver*, 11 by 7 by 4 cm. does not seem much enlarged and its cut surface appears normal. The *gall bladder* is filled with a slightly milky, thin fluid.

The large blood vessels are normal. The *lymph nodes* throughout the whole body are dark red, large and soft, and many hemorrhages are found in the retroperitoneal tissue. Skin and subcutaneous tissue over the sternum and over the umbilicus have a thickness of 1.5 cm., but in the region of the liver the thickness is only 3 mm; on the right thigh the thickness is again more than 1.5 cm. The muscles are edematous also.

The fronto-occipital circumference is 34 cm. The scalp is very edematous and hemorrhagic throughout; the circumference of the skull itself is only 26 cm. The large fontanel measures 3 by 2 cm. there is no small fontanel. The hardness of the *bones of the skull* is normal; there is no hemorrhage in the subdural cavity; tentorium and falx are intact. Several small hemorrhages are found in the dura mater and the pia mater is very hyperemic. The *brain substance* is edematous and pale; the base of the skull is normal; the hypophysis in the diaphragma sellae appears normal.

Attempts to find the *parathyroid glands* in the extremely edematous tissue were made; two small pieces were found which could correspond to the parathyroids; at the lower pole of the right thyroid gland a piece is found which in color and consistency is similar to a parathyroid but it measures 1 by 0.4 cm.

Weight of organs:

Liver	200	grams
Spleen	35	"
Each kidney	5	"
Suprarenals together	7	"

The six pieces of *placenta* which were sent to the laboratory are pale and very edematous, the cord is edematous and has the thickness of a man's thumb. No other anomalies are observed. The weight of the pieces is one kilogram.

MICROSCOPIC.—Thymus:—There are many Hassal bodies in different stages; large hemorrhages are found in the medullary substance and in the interstitial tissue an enormous edema is found.

Heart Muscle: Much edema. No pigment.

Lung: The edema is found especially in the subpleural and peribronchial tissue; the capillaries seem not to be compressed.

Thyroid: No special findings.

All the pieces which were believed to be parathyroid are ectopic thymus tissue.

Spleen: Microscopically no follicles are found. There are many accumulations of myeloic cells and in the surroundings of blood vessels mononuclear elements are found. The oxydase reaction is positive only upon a part of the myeloic cells;

in the surroundings of some blood vessels a large number of cells with positive reaction is noted. A little iron pigment is present.

Liver: The liver contains very many myeloid foci. The oxydase reaction shows about the same percentage of positive cells as in the spleen. In the portal vessels very many nucleated cells are situated, the nucleated cells here are more abundant than in the vessels of other organs. A rough count gives the percentage of twenty for the nucleated cells in the blood vessels of other organs.

Pancreas: The dark spot which has been found while trimming the section is a myeloic focus, chiefly perivascular and contains many leucocytes.

Intestines: The hemorrhagic parts contain chiefly erythroblasts. The external muscle coat is partly destroyed by edema and infiltration. Lymph spaces in the mesentery are packed with myeloic cells.

Suprarenals: Small myeloic focus in cortex.

Kidney: The myeloic foci are practically all perivascular; they are partly circumscribed, partly diffuse. In the epithelial cells of the convoluted tubules large amounts of brown pigment are found, most of which give positive iron reaction; in one collecting tubule the same pigment is found. The contents of tubules do not give iron reaction.

Testicles: Edema; myeloic cells in blood vessels.

Placenta: Not all the parts of placenta show edema; there are chorionic villi which look perfectly normal.

The *skin* is extremely edematous and the underlying muscle is much more edematous than the heart muscle.

The fat stain shows middle sized sudanophil granulations in many Kupffer cells, some of which are completely filled with the fat droplets. In the kidney no fat is found.

The hemorrhagic axillary *lymph nodes* do not show any lymphoid tissue, consisting completely of myeloic tissue, similar to that in the liver and spleen. At several points in the edematous tissue which surrounds the lymph nodes large giant cells are found. Their presence may be due to breaking down of fat tissue(?).

In the sections of *bone marrow* the cells are not very well preserved, but the presence of very large numbers of nucleated cells which are very similar, apparently identical, with the elements described in the other organs, is beyond doubt. There are very few megakaryocytes, if any at all.

DIAGNOSIS.—Fetal hydrops of myeloic type with erythroblastosis. Hypertrophy of heart. Smallness of thymus gland.

Such cases are very rare; even when we count all cases of congenital hydrops, their number in the whole literature does not reach the first hundred. The number of cases with the myeloic foci in different organs as described by Schridde is much smaller, there being hardly more than a score of descriptions. The complete mystery in which the origin of this fetal disease is involved makes it a duty to report every case so that the accumulation of material may furnish a basis for further study. To this purpose I want to discuss the important points of our case.

The child was born immature. (This is frequently the case regardless of good or bad health of the mother during pregnancy.) This point has to be considered in recording the weight of hydropic babies. Comparing it with the weight of normal newborn babies does not

give the right idea; they must always be compared with premature babies of the same month.

The lanugo was well developed; this sharply differentiates the fetal hydrops in man from the edematous condition in which calves are born not unfrequently for these malformed calves have no hairs.

The autopsy record stated the presence of deep furrows at the site of gauze bandages with which the wrists and the ankles of the baby had been tied after death; but similar furrows have been described[1] where bandages had not been used; the circular arrangement of firm subcutaneous tissue prevents the accumulation of anasarca at these points and so the "fencing glove shape" of the wrist is formed. It can be seen in several pictures of hydropic newborns. The consistency of the edematous skin was that usually found in intense edema; there was nothing to point toward any change in the tissues themselves, as in sclerema.

In our case the diaphragm was nearly flush with the costal arch on both sides; in other cases (Ballantyne[5]), on the contrary, it was high and all of the organs of the thorax and the neck were situated higher up than normally. Such differences chiefly depend upon the amount of fluid which distends the abdominal cavity and the pleural cavities respectively.

The smallness of the thymus gland seems of interest to me. We are going to see that our attempts to explain fetal hydrops, so far, have been failures. No maternal, paternal, or other condition give any clew; so it must be important to look for signs in the constitution of the fetus itself. It can be expected that the size relations of the organs, especially of the endocrine glands, may be valuable to that purpose. The smallness of the thymus in one case was observed more than thirty years ago by Virchow and later by Schridde in one of his cases with erythroblastosis. Most of the other reports do not mention the thymus.

The hypertrophy of the heart is probably present in most cases with the myeloic changes; Schridde observed it in all of his cases.

The spleen corresponds in size, weight, consistency and appearance of cut surface to Schridde's cases and to the cases described under other names by other authors in previous years. It is really not astonishing that such cases have been taken for leucemia.

In the many unsuccessful attempts to explain fetal hydrops not only the condition of the kidney of the mother has been studied but that of the fetal kidney as well, not a promising way since most of the fetal waste is not excreted by the kidney but by the placenta. (Excretion of much waste products from the kidneys would result in poisoning the amniotic fluid.) And de facto in most cases of fetal anasarca the kidneys show no lesion which could be held responsible for the edema.

The myeloic foci may be visible to the naked eye; Schridde saw them in one of his cases on the cut surface at the borderline of cortex and pyramids; it is interesting to note, however, that he saw them only in his later case—not in the first one. That means probably, that only the microscopic picture induced him to see whether he could observe these foci with the unaided eye as well. The same applies for the cut surface of liver. But where the lesions are accompanied by hemorrhage there is no difficulty in detecting them in the gross; this was the case with the intestine and the lymph nodes in our case. The swelling of the lymph nodes was much greater than in the cases hitherto reported. In the hemorrhagic axillary lymph nodes there was a peculiar feature which I believe was not directly connected with the myeloic change. In the surroundings of the former lymph node which was transformed into myeloic tissue, giant cells were present. They were of very different size and shape, the smallest one not much larger than connective tissue cells, from which they apparently originated, and the largest one measured 61 mikra and contained more than 20 nuclei. They resemble, for the most part, foreign body giant cells and if a hypothesis concerning their origin may be ventured, I would consider them as due to broken down tissue from the lymph nodes. It may be mentioned in this connection that no megakaryocytes were found in any organ, not even in the one piece of bone marrow which was examined. In one of the cases in the literature[2] megakaryocytes have been found in the mesenteric lymph nodes.

Since all these findings evidently show a systemic lesion the most important question arises concerning the blood picture of this fetus. The baby was dead when born and no blood smears have been taken during autopsy. But the blood filling distended blood vessels in undiseased surroundings and a recent hemorrhage in the skin showed the large number of nucleated cells easily; counting through a slit diaphragm in the eyepiece (after the principle of Ehrlich) gave a percentage of 20 for the nucleated cells, and in the portal vessels a still higher one. The other question—whether there was anemia and to what degree—could not be answered exactly but the whole picture in the gross as well as microscopically indicated severe anemia.

In order to get more information concerning the most affected organs, stains have been applied for fat substances, for iron, and for oxydase granulations. In the liver many Kupffer cells were filled with middle-sized sudanophil droplets, while the liver cells themselves contained only small brownish droplets in smaller number; the iron reaction gave an opposite picture since the epithelial cells of the liver were found filled with green material while the Kupffer cells occasionally contained some small green masses. (Nishimura's method was used.) From the large amount of pigment which was present in

the epithelial cells of the convoluted tubules of the kidney the greater part gave positive iron reaction and the small amount which failed to do so showed the same size, shape, situation, and original color as the rest; all this pigment assumed only a brownish hue in the sudan stain. Similar pigment was present in the cells of one collecting tubule. In the unstained section and in the hematoxylin-eosin stain the pigment was bronze colored. The contents of the lumen of some tubules appeared similar but failed also to give an iron reaction. The spleen showed a moderate hemosiderosis.

The benzidin reaction for oxydase granules confirmed the findings of the hematoxylin-eosin stain; the greater portion of the myeloic tissue consisted of erythroblasts and did not give oxydase reactions, the cells which gave the reaction were especially arranged in the surroundings of blood vessels. They partly form real coats. These findings correspond to those of Schridde with the exception that the kidney pigment in his case did not give an iron reaction.

There is no doubt that our case is one of those cases of congenital hydrops which are distinguished by severe anemia, more or less marked myeloic reaction of tissues and hypertrophy of the heart. This group has been recognized since 1910, when Schridde[3] published his study. The differences between our case and those of Schridde are of minor importance only.

Even a short review of the literature will convince everyone that fetal hydrops, in general, is no pathologic entity; the question arises if or how far the cases as described by Schridde are an entity. I do not think this problem can be solved at present. It has been suggested by Trautmann and others[4] that the eryblastosis is the prominent feature in these cases and that they should be called "erythroblastosis," thus considering the general edema as a secondary factor only. In my opinion, it would not be well to apply the term fetal erythroblastosis, for, so far, no case has been described which showed the erythroblastosis without the edema and the name ought to be reserved for such cases. Meanwhile, it may serve our purposes best to include the two outstanding symptoms and to speak about "fetal hydrops with erythroblastosis," thus differentiating these interesting cases from other instances of congenital dropsy.

Nothing is known in our case of similar occurrences in the family of the parents; I mention that because Ballantyne[5] saw 3 cases from the same mother and a fourth from the wife of this woman's brother; in such a rare condition even this one instance of familial occurrence is very remarkable and Ballantyne[5] quotes another instance where a woman gave birth to three hydropic babies. I see no possibility in our case to establish a direct connection between the mysterious death of the woman's previous babies and the disease of this last one. Since, while not pregnant, the mother is apparently healthy, in this

case as in others the disease of the fetus is not secondary to the pregnancy troubles of the mother but on the contrary, the mother is made sick from carrying an anomalous fetus.

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TWO CASES REPRESENTING UNUSUAL TYPES OF RENAL TUBERCULOSIS*

By Henry G. Bugbee, M.D., F.A.C.S.
(Urologist)

In no other type of kidney pathology are the lesions so varied and the resulting symptoms so often misleading as in renal tuberculosis. A diagnosis of renal tuberculosis may be impossible owing to extreme difficulty in carrying out diagnostic procedures at our disposal, or one may fail to make an accurate diagnosis in cases in which all methods of investigation are easily employed, as in the first case which I wish to report.

The patient, a woman, A. H., aged twenty-six, married, first came under my observation December 13, 1923. She gave a history of painless hematuria, continuous with exacerbations for a period of four years. Slight vesical irritability had been noted at the intervals when the hematuria was most marked, but bladder symptoms were never pronounced. Frequent urinalysis by her physician had revealed blood only. In various laboratory examinations no tubercle bacilli had ever been found, and guinea-pig inoculations had been negative.

The physical examination showed a rather pale, thin individual, of small frame. The teeth, tonsils, chest, abdomen and vaginal examinations were negative. The hemoglobin was 50 per cent.

Cystoscopic examination showed a normal bladder and ureteral orifices. The ureters were catheterized without difficulty. The urine from the right kidney showed numerous blood cells, few pus cells, staphylococci, on culture, no tubercle bacilli, and no tumor cells. The urine from the left kidney was negative and the function of this kidney was five times that of the right.

A pyelogram of the right kidney at this time showed a moderate dilatation of the calyces with loss of outline of the minor calyces, the pelvic shadow being light in the center (a picture which had been noted in 2 cases of a papillary tumor of the renal pelvis).

The possibility of focal infection elsewhere in the body was eliminated. The patient was given pelvic lavage, urinary antiseptics, and constitutional treatment and did not again appear for examination until three months later. At that time she gave the same history of continuous bleeding. The hemoglobin was 42 per cent; otherwise the physical examination was negative. Blood urea was 14.3 mg.

Cystoscopic examination gave the same picture of a normal bladder, the ureters were easily catheterized and the function of the right kidney was now found to be two-thirds that of the left.

The urine from the right kidney now contained blood cells and revealed many atypical epithelia; no pus cells or bacteria. The pyelogram showed a more pronounced light area in the center of the pelvis and a diagnosis of probable tumor of the pelvis of the kidney was made.

A normal-sized kidney was easily removed through a lumbar incision. On section of the kidney a well-organized blood clot was found filling the center of the pelvis and extending into the calyces. This had caused the variation in density

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of the pelvic shadow in the pyelogram. The patient made an uneventful recovery. The pathologic report of the specimen is as follows:

Macroscopic examination.—Specimen consists of a kidney with 2 cm. of ureter. The kidney measures 7.5 by 3.5 cm. The surface presents several cystic dilatations at the lower pole, but is otherwise smooth. Section shows the ureter apparently distended, with the formation of cavities, evidently cystic dilatations of several calyces at one pole. They are from 1.5 to 2.5 cm. in diameter. The pelvis and

Fig. 1.—Case I. Pyelogram showing filling defect, simulating pelvic tumor, due to organized blood clot in renal pelvis.

some of the calyces are filled with a tenacious blood clot, and there are a few very slight ecchymoses in the mucosa of the pelvis near the ureter.

Microscopic examination.—Sections from several portions of the cystic dilatations in the kidney show almost complete atrophy of the cortex at these points with fibrosis of the glomeruli and tubules as well. Large lymphoid deposits are found in this region.

The lining of the cysts shows an ulcerated membrane composed of fibrous tissue, endothelial cells and round cells, throughout which are scattered considerable numbers of discrete and confluent tubercles. There is practically no caseation, the tubercles being composed chiefly of endothelial cells and giant cells. The latter

are fairly numerous, rather irregular, but a few of them are circular and clearly of the Langhans' type. The infiltration with round and plasma cells is very extensive. The calyces which are less dilated show an inflammation also of the pelvic epithelium with occasional desquamation of a few cells, but marked round and plasma cell infiltration throughout.

There is extensive interstitial fibrosis of the pyramids, of numerous glomeruli, and round cell infiltration extending out along the course of the vessels as far back as the cortex, but isolated tubercles are not found in the kidney parenchyma. The

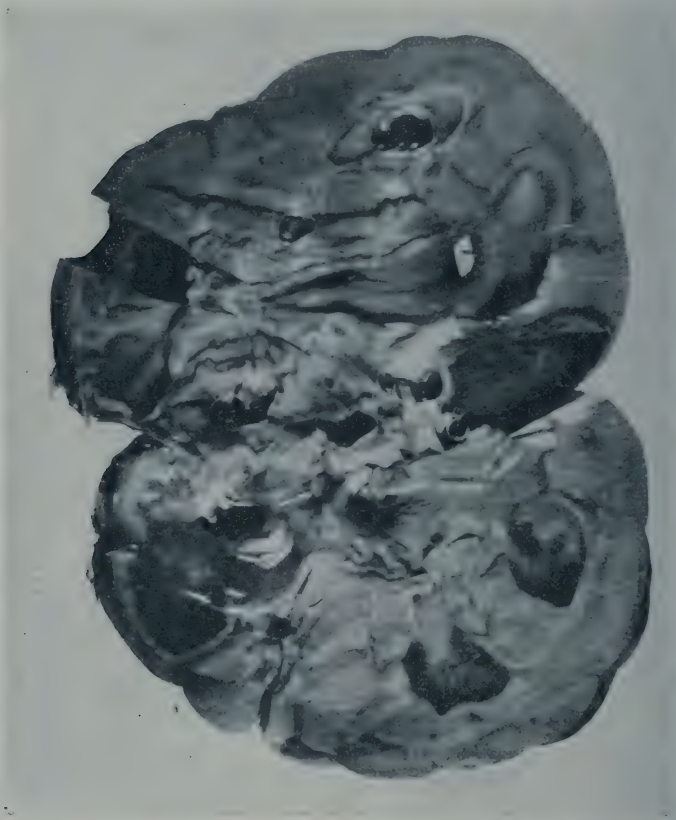


Fig. 2.—Case I. Kidney after removal of clot.

small hemorrhagic lesions from the pelvis shows fresh hemorrhage and chronic inflammation, but no tubercles.

Diagnosis.—Chronic tuberculosis of the kidney. Fibrosis without necrosis.

The second case was that of a woman of twenty-seven, married three years, had two children. The family history was negative. She had an operation for inguinal hernia nine years ago. No other illnesses.

On entrance to the hospital, October 18, 1922, she complained of severe pain in the right upper abdomen and back of one week's duration, diarrhea, chills, fever, and swelling of the feet, no urinary symptoms. Temperature on admission 104° F., pulse 134; respirations 36. Physical examination showed a heavily coated tongue; a dilated heart giving a loud systolic murmur, apex beat strongest in the fourth interspace and irregular; moderate edema of the feet and ankles. There

was a large tender mass in the right upper abdomen and lumbar region unquestionably a kidney.

Cystoscopic examination revealed a moderate congestion of the vesical neck and the right ureteral orifice was not functioning. A catheter passed to the left kidney, the urine collected showing a normal function on this side and an absence of

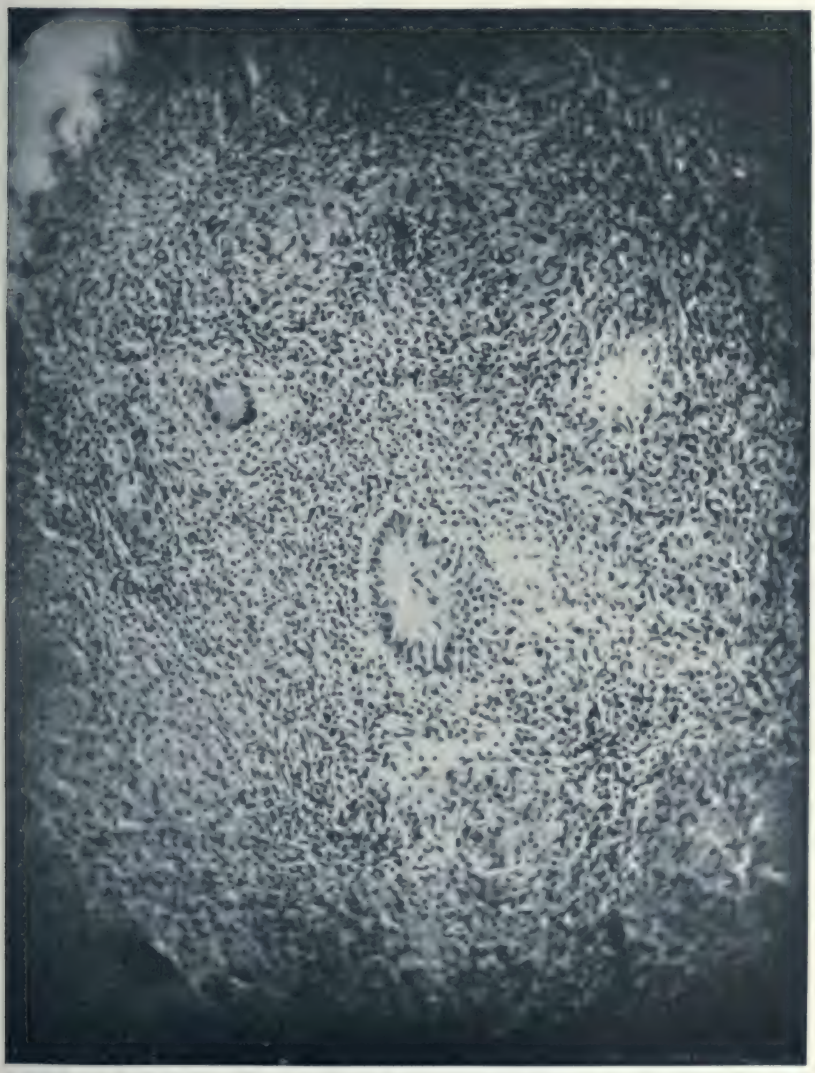


Fig. 3.—Case I. Fibrosis and round cell infiltration; scattered tubercles; no caseation.

infection; on the right side the catheter was obstructed at 22 cm. from the bladder, no urine was obtained. Roentgenograms revealed an oval shaped calculus 2.5 cm. long by 1.5 cm. in width lodged in the right ureter opposite the third lumbar vertebra.

Under local anesthesia a right lumbar incision was made exposing the kidney mass. The tumor was incised and found to consist of a thinned out cortex surrounding a dilated pelvis and calyces which contained about 8 ounces of thick foul

NOTE: For Fig. 4, see Frontispiece.

smelling pus. The patient's condition did not warrant further exploration. A large tube was inserted into the kidney pelvis and the wound closed about it.

Aside from the first few days after operation, during which time the heart action was irregular and weak, the patient's condition improved slowly and she was allowed to leave the hospital on November 22, 1922, to return for general observation and dressings of the discharging sinus in the right lumbar region. The

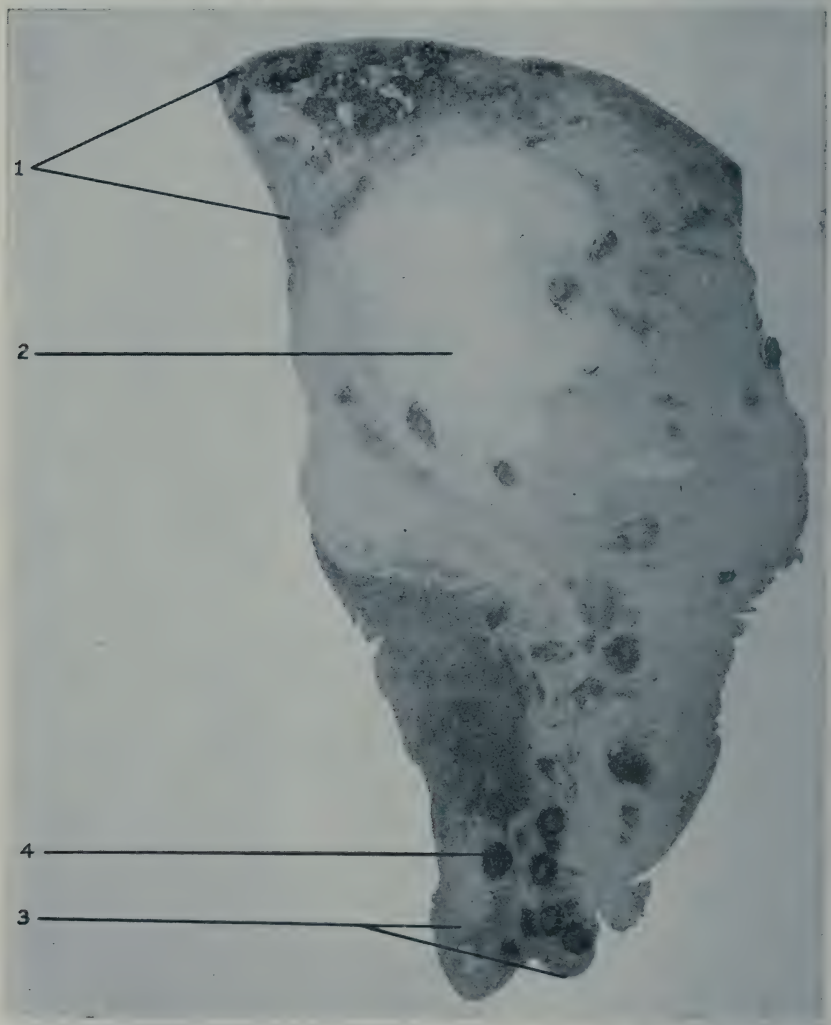


Fig. 5.—Showing *(1)* compressed kidney substance, *(2)* fat. *(3)* apex of medullary pyramid, and *(4)* tubercles. x10.

discharge from this sinus had been constantly decreasing and then consisted of thin pus and apparently no urine. The blood urea was 13.4 mg. per 100 c.c. of blood.

The patient was under observation until February 14, 1923, when she reentered the hospital. During these three months her general physical condition and especially the cardiac condition improved steadily. She had no urinary symptoms and no discharge of urine from the lumbar sinus. Occasional discharges of thin

pus were noticed however, and a roentgenogram showed the ureteral calculus lodged in the pelvic portion of the right ureter. Cystoscopic examination showed a bladder and left kidney free of infection and an absence of function on the right side. Blood urea was 12.6 mg. and phthalein output 55 per cent in two hours. The temperature was normal, pulse range 80 to 90 and respirations normal. There was no edema of the lower extremities.

Under gas-oxygen anesthesia, the right kidney was removed through a lumbar incision with surprisingly little difficulty considering the former operation and the extensive suppuration present at that time. The wound was closed about a drain and the postoperative history was uneventful. The temperature rose several

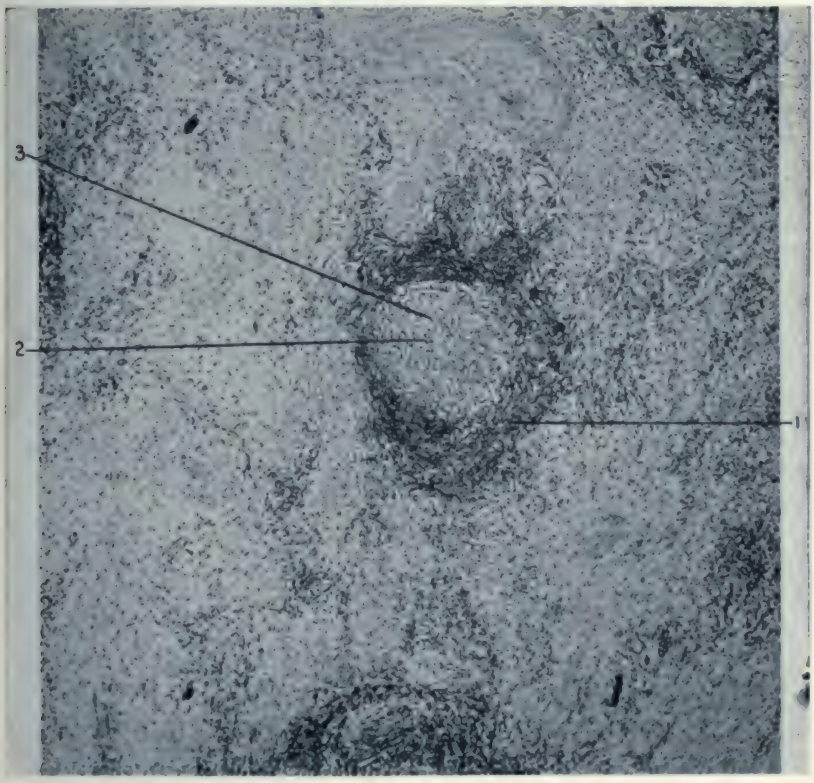


Fig. 6.—Case II. Showing *(1)* round cells at periphery of tubercle, *(2)* epithelioid cells, and *(3)* coagulation necrosis. x72.

times to 101°, the pulse never above 100. The patient was discharged cured on March 21, 1923.

The kidney specimen in this case is of especial interest. What appeared at the first operation to be a pyonephrotic kidney secondary to a ureteral obstruction, when removed at the second operation, presented an unusual picture. The gross appearance was that of a hypernephroma which, however, was not substantiated by pathologic examination.

The pathologic description of the specimen is as follows:

Gross appearance.—The specimen was a globular mass which had been opened through the center and measured 13 by 10 cm. in diameter. The outer surface was irregular with adherent perirenal fat. The cut surface was smooth and glistening and showed white strands outlining irregular, pink lobules which had yellow fatty

centers. The largest of these fatty areas was about 4 by 3 cm. in diameter. There were no softened areas but a few small red, shallow depressions were present. One such depression or cavity existed between the growth and a much compressed piece of kidney substance at the upper pole. No adrenal was found. There was little in the mass to distinguish it as kidney.

Microscopic examination.—Just under the kidney capsule was a zone of cellular connective tissue in which lay a number of small round and elliptical tubules lined with a single layer of regular, cuboidal epithelial cells. Most of the tubules were empty, some contained hyaline material. There were also many glomeruli with greatly thickened capsules and capillaries. The lumen of a few capillaries could still be distinguished by means of the nuclei in their lining cells. Between these compressed glomeruli and tubules was much diffuse mononuclear cell infiltration. Some hemorrhage had occurred, probably traumatic at operation. A number of round tubercles, composed of mononuclear and epithelioid cells, with a small amount of coagulation necrosis were found in this zone, which represents compressed kidney cortex. Giant cells were few in number. The tubercles were more numerous in the compressed kidney medulla and several were present in one medullary pyramid which had partly retained its shape and whose apex was covered with stratified epithelium. In other places, the walls of the kidney calyces were greatly thickened, studded with tubercles and calyx cavity filled with fat. Thus, the yellow areas are accounted for.

The lesion is one of chronic tuberculosis, probably bovine in type.

Since leaving the hospital, the patient has had a miscarriage and curettage during which time pus cells were found in the urine. At the present time she is free of symptoms and in good physical condition.

The outstanding features of this case are the sudden onset of the symptoms, with the ureteral obstruction, the extremely poor condition of the patient when first seen, the rapid improvement after drainage of the kidney and the pathologic study of the kidney after removal, showing almost complete replacement of kidney tissue by fat and the chronic low grade tuberculous infection in the thin compressed cortex with the absence of previous urinary symptoms or secondary lesions of the ureter and bladder.

These two cases presented a chronic tuberculous inflammation of the kidney, almost free from necrosis, with no cavity formation and with no involvement of the lower urinary tract. No tubercle bacilli could be isolated by examination of the urine or demonstrated by guinea-pig inoculation. In one case the symptoms and findings seemed to be characteristic of a tumor of the renal pelvis with persistent hematuria as the predominating symptom, and in the second case the kidney was almost entirely replaced by fat.

They demonstrate a type of infection quite different from the usual picture of renal tuberculosis with active lesion in the lower urinary tract and its accompanying distressing urinary symptoms. They lead one to believe that tuberculosis of the kidney probably exists much more frequently than is generally conceded, that a correct diagnosis of this type of case is often overlooked, and that such a low grade tuberculous renal infection is self-limiting in some cases.

CASE OF PREMATURE LABOR WITH SURVIVAL OF THE CHILD

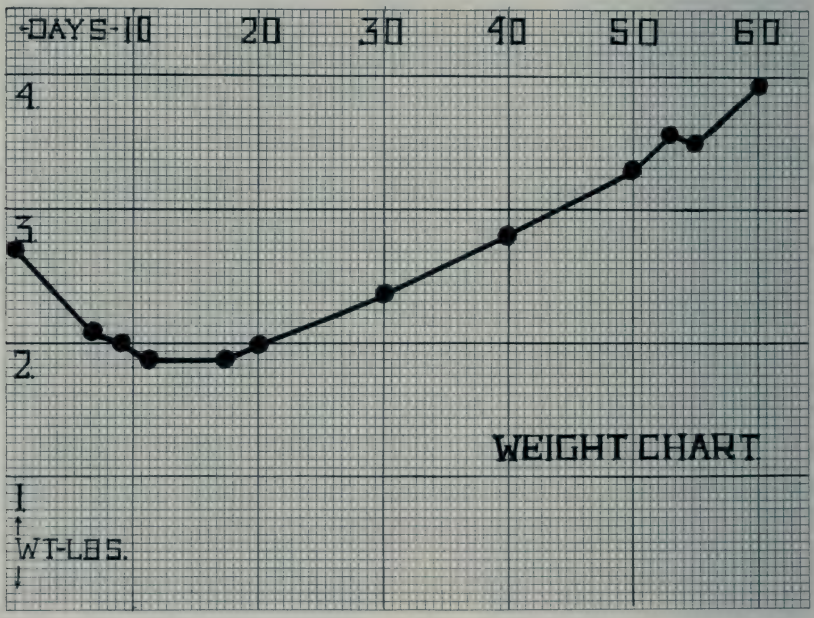
By Edward C. Lyon, Jr., M.D.
(Junior Attending Surgeon)

THE survival of infants born very prematurely is sufficiently uncommon to warrant the reporting of an additional case, especially as the mother in this instance is an intelligent woman and gives a definite history from which it is possible to estimate with considerable accuracy the length of her pregnancy. Although this baby had a very precarious existence at the start, and overcame many vicissitudes, he is now at sixteen months a strong, sturdy boy, apparently normal in every respect.

From the second month of her pregnancy, the mother of this infant was followed in the Prenatal Clinic of the Woman's Hospital, to which she reported every two weeks. She was an Austrian by birth, twenty-nine years of age, married ten years, with a history of two full term normal deliveries, followed by one spontaneous miscarriage at four months. Nothing abnormal was found on physical examination, except a moderate hypertension. This varied throughout her pregnancy from 135/78 to 145/80. Her Wassermann was negative. Menstruation had always been regular every twenty-eight days, lasting from four to five days. The last period was June 14, 1923, occurring at the regular time. The amount of flow and duration of this period were normal. The patient is positive of both the date and the character of this period. When examined on August 24, in the clinic, a notation on her chart states, "The uterus is size of two months' pregnancy." On December 11, 1923, she was admitted to the ward with a history of ruptured membranes. She was observed for four days and discharged, having had during this time no escape of fluid, no flow, no pain, and the cervix being long and closed. On December 21, she was readmitted because of abdominal cramps and vaginal bleeding, probably about four ounces in all. The patient was in good condition, the cervix admitted one finger, no placenta was felt, and the diagnosis was "accidental hemorrhage from premature separation of the placenta." The patient was put to bed and observed. On December 23, she went into active labor, and at the end of six hours was delivered normally. The placenta was soft and mushy, small in size, and at least two-thirds of it was a pale pinkish color and bloodless. The pathologist's report states, "Placenta with regressive changes." The moderate hypertension, the accidental hemorrhage and the condition of the placenta, supported the diagnosis of partial premature separation of the placenta.

The baby at birth weighed two pounds and eleven ounces, measured thirty-five centimeters long, and appeared to be very premature and weak. Because this baby survived, the duration of the pregnancy becomes the chief point of interest. The last period of this patient began on June 14, and her delivery occurred on December 23, making the delivery exactly twenty-seven weeks and three days, or one hundred and ninety-two days after the first day of her last period. This June period was normal in duration and amount, and was preceded by periods occurring regularly at the expected time and also normal in duration and amount. If conception in this case occurred before this June period, it seems fair to assume that it was at a time nearer the June period than the preceding one in May. We have all seen pregnant women who at the regular menstrual time have had a more

or less altered flow; usually this is lessened in both amount and duration, often being a mere spotting. Rarely does a period normal in time of onset, duration, and amount of flow occur coincident with a pregnancy unless conception has occurred just prior or near to that period. It seems logical in this case to place the outside limit for conception at not more than three weeks prior to the flowing in June and most probably only a few days before, which would make the maximum duration of pregnancy from two hundred to two hundred and ten days. The baby was thirty-five centimeters long, which by the usual computation would make the pregnancy seven lunar months or one hundred and ninety-six days, a method that we know is not accurate, but which with other facts is often helpful. With this data, is it justifiable to consider that we have two hundred and ten days, or thirty weeks, as a possible maximum for the duration of this pregnancy and more probably around two hundred days, or between twenty-eight and twenty-nine weeks as



the actual length? We have felt that though not proved, such an assumption is within the realm of probability.

After delivery, the child was oiled, rolled in a cotton jacket, and placed in a hot bed. At the Woman's Hospital we do not use incubators or an incubator room, but care for our premature babies in the open nursery. The temperature of the bed was maintained by means of an electric pad, and determined by a thermometer which was kept in the bed. The baby soon showed the need of fluid, and on the second day received 20 c.c. of saline solution subcutaneously, while on the third day, 20 c.c. were given intraperitoneally. Saline solution was again given on the eighth, tenth, eleventh, fourteenth and sixteenth days, usually intraperitoneally. The mother had but little milk, but all that could be obtained from her was removed by a breast pump and fed to the baby. When it was seen the mother could not supply milk, an active propaganda was started among all nursing mothers in the hospital, both ward and private, and for a time all went well, breast milk being obtained from many patients in varying amounts. On the twenty-first day, the supply of breast milk was less than required, and feedings of part breast milk, and part formula were begun. After this, on some days the baby received all for-

mula, occasionally all breast milk, but usually a combination of the two. From the fifty-fifth day the feedings were entirely of formula. The baby weighed two pounds and eleven ounces at birth, and was discharged on the ninety-seventh day weighing six pounds and seven ounces.

This case has been followed carefully since discharged from the hospital, and the last report at sixteen months, stated the baby then weighed twenty-one pounds and five ounces. The accompanying chart graphically shows the weight curve from which it can be seen that for over a week the baby's weight remained at one pound and fourteen ounces. We have had at the Woman's Hospital no other case as premature as this one, in which we succeeded in raising the baby.

INTRALIGAMENTOUS PREGNANCY*

Discussion with Report of a Left Intraligamentous Full Term Pregnancy with Preoperative Dead Fetus—Mother Living

By William T. Kennedy, M.A., M.B. (Tor.)
(Junior Attending Surgeon)

IT is not my purpose to submit a complete review of the subject or include all the cases so far reported in the literature but to briefly learn from a study of the patients who have been operated upon, what is the best procedure, whereby we may first save the mother and if the child has reached viability and is still alive, to obtain a living child. All statistics have not clearly separated those patients having living babies from those having dead babies before operation. Rosenblatt[1] reports 86 cases of abdominal pregnancy, bringing, he says, the literature to date, making 295 authentic cases of advanced abdominal pregnancy. Of Rosenblatt's 86 cases, 11 were intraligamentous and of Sittner's[2] 184 cases of abdominal pregnancy, 39 were intraligamentous. Of Sittner's 39 intraligamentous cases, 24 were unruptured and 15 ruptured at the time of operation. Rader[3] reports a case in which both mother and child were living, and he, after having made a careful study of the literature, says his case is the 160th in which the mother and child both lived. Hence, of 270 abdominal cases, 50, or 18.5 per cent, were intraligamentous.

FREQUENCY IN ECTOPIC STUDIES

Farrar[4] analyzed 309 cases of ectopic gestation in a period of ten years at the Woman's Hospital and found three advanced abdominal pregnancies. Lewis[5] analyzed 183 cases, reporting 2 which were progressing to advanced pregnancy. Luker[6] found 1 advanced among 253 ectopic pregnancies. Mason[7] found one ovarian advanced pregnancy in an analysis of 400 cases. Williams[8] reports four advanced cases in 276 ectopic pregnancies and De Suvo reports 2 advanced cases in 52 ectopic pregnancies. Total, 13 advanced abdominal pregnancies in 1,473 ectopic pregnancies, or 0.885 per cent.

FREQUENCY IN PREGNANCY

Harris[10] says Brandl believes that abdominal pregnancy occurs once in 12,000 cases while McPherson[11] reports 3 advanced abdominal pregnancies in 75,000 admissions. The average of these figures would be 1 in 18,500, or 0.0054 per cent. Graffagnino[12] rather changes these figures by

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reporting 11 cases in 18,835 cases, or 1 in 1,712, almost 10 times the figures of the other authors.

Since intraligamentous pregnancy is calculated as 18.5 per cent of abdominal pregnancies going to full term and since abdominal pregnancies are 0.885 per cent of all ectopic pregnancies then intraligamentous pregnancy should take place 0.163 per cent, or 1 in 613 cases of ectopic pregnancy.

I take the opportunity here of inserting a case of intraligamentous pregnancy reported by Ellison[13] which had ruptured before operation, where the ovum was developing between the layers of the right broad ligament in the form of a cone-shaped mass with its apex pointing to the middle of the isthmic portion of the tube. The ovum had ruptured, forming a retroperitoneal clot extending from this cone to the pelvis, from the iliac fossa up to the kidney. The tube was removed, was reported normal and chorionic villi were found between the layers of the broad ligament.

HISTORY

Symptoms.—(1) Amenorrhea.

(2) Pain, quite acute (without shock as occurs in the hemorrhage into the peritoneal cavity), appearing from the sixth to tenth week of pregnancy and gradually subsiding.

(3) Occasional attacks of pain in later pregnancy which are not sufficient to keep the patient in bed.

(4) Abdominal enlargement.

Signs.—In the early months are:

(1) Acute tenderness of the fundus and the parametrium into which the ovum has ruptured.

(2) Thickening of the broad ligament to simulate an ectopic pregnancy further advanced than the history indicates.

(3) Fundus enlarged but does not conform to the amenorrhea.

In the later months there are:

(1) Fetal movements and fetal heart sounds.

(2) Abdominal enlargement almost corresponding with the history.

(3) Fundus can be felt on the side opposite to the pregnancy.

(4) Uterine souffle only audible over the uninvolved broad ligament. (Goff.)

(5) Cervix retracted with the fundus to be in a position high above the symphysis and inaccessible.

(6) Culdesac bulges, does not fluctuate and feels like a dense spongy substance.

(7) Radiograph to illustrate position and bony arrangement to determine whether the child is living or dead.

DISPOSITION OF THE PLACENTA

The references in the years 1922, 1923, and 1924 to intraligamentous pregnancy in the *Index Medicus* were investigated but all the literature was not available. In this period there were 33 cases of advanced abdominal pregnancy which were studied. Of these, 12 had dead babies and in 4 cases nothing was said about the placenta. This leaves 17 cases to consider. Of the 17 cases the placenta was removed and the abdomen closed in 11; in 3, the placenta was left and the abdomen closed; in 2 cases the placenta was left to come away, the abdomen being drained; and in 1 case the placenta was removed both by vaginal and abdominal operation. Table I illustrates the mortality percentage during this period.

TABLE I

MORTALITY PERCENTAGE FROM 1922 TO 1924

PLACENTA	CASES	DEATHS	MORTALITY PER CENT
1922-24			
Removed	11	0	0
Left with closure	3	1	33.3
Left to come away with drainage	2	1	50.
Vaginal-abdominal operation	1	1	100.
Average Mortality—17.7%.			

A comparison of these figures can be made with those reported by Beck[14] in operations performed during the years from 1809 to 1919.

TABLE II

MORTALITY PERCENTAGE (BECK) FROM 1809 TO 1919

PLACENTA	CASES	DEATHS	MORTALITY PER CENT
1809-1919			
Removed	159	34	21.3
Left	98	55	56.
Average Mortality—34.2%			
1890-1919			
Removed	137	23	16.7
Left to be absorbed	12	4	33.3
Left with drainage	52	22	38.7
Average Mortality—24.4%.			

Rosenblatt reports 22 cases with 2 deaths of all cases where the placenta was removed and the abdomen closed. Prowossud,[15] reporting 190 cases in 1910, gives a general mortality of 36.7 per cent. Of these, when the placenta was removed and the abdomen closed, mortality was 25 per cent; with marsupialization and drainage, the mortality was 27 per cent; and with marsupialization without drainage, the mortality was 45 per cent.

Hence, for all periods we find that the mortality is least in cases where the placenta was entirely removed and the abdomen closed and is greatest

in those cases where the placenta was left and allowed to come away with drainage, except in one instance where the percentage cannot be easily calculated as there is only 1 case where both vaginal and abdominal operation was done.

REPORT OF THE CASE

Patient, married eight years, had one pregnancy six years ago, with a living child. She has been in general good health with no history of any pelvic inflammation since that time. There was slight endocervicitis; Wassermann negative. She came to be examined, after having missed two menstruations, on account of a sharp sudden pain in the lower left quadrant of the abdomen. At that time a question of left salpingitis was considered on account of the thickening of the left perimetrium. The pain gradually passed away and the patient was comfortable for about one month. She entered the hospital for daily observation for one week, when diagnosis was made of intrauterine pregnancy with corpus luteum cyst of the left ovary. The patient left the hospital and the abdomen continued to enlarge corresponding to the advancement of a normal pregnancy. In the beginning of the ninth month the patient came in, stating that she had not felt life for four days. On examination no fetal heart could be heard. A mass to the right of the pregnancy did not seem unlike the uterus. The cervix was high and inaccessible. The uterine souffle could be heard only over the right broad ligament. The culdesac was bulging and there was considerable pressure over the rectum. It was decided that the pregnancy was not normal so an x-ray was taken to determine the position of the child. It was found to be a breech presentation with the sacrum very low in the pelvis. (R.S.A.) The patient was then prepared for transfusion at the same time that operation would be done.

Findings at operation: After a left rectus incision was made, the mass containing the fetus was fully exposed. The fetus could be seen through a thin membrane which was unruptured and did not look unlike peritoneum. On further examination the uterus was closely related to the sac on its right, and on the middle of the sac posteriorly, could be traced the sigmoid. On opening the sac at its thinnest portion a fetus weighing 6 lbs. 12 oz., dead, but very slightly macerated was removed and there was no hemorrhage. By gentle separation the placenta was removed entirely from the left broad ligament without any hemorrhage and the sac was closed after inserting a drain into the vagina. The abdomen was closed without drainage. The patient made a normal convalescence and the drainage sinus closed in about one hundred days.

CONCLUSIONS

(1) In view of the fact that hemorrhage is the first most serious consequence at operation all preparation should be made to transfuse a patient before operation.

(2) In view of the fact that the greatest mortality is accompanied by packing and drainage of the abdominal incision, every effort where possible should be made to close the incision following careful ligation for hemorrhage.

(3) Intraligamentous pregnancy lends itself to drainage better than abdominal pregnancy because the peritoneum can be sewed to the incision making the drainage extraperitoneal.

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BILHARZIA IN THE APPENDIX

By Alfred Plaut, M.D.
(Pathologist)

THE purpose of presenting this report is to emphasize three facts:

1. The occurrence of bilharziosis in the large cities of the East.
2. The possibility of complete absence of intestinal symptoms.
3. The fact that the position of the spine in the egg is not characteristic of a different species of Bilharzia.

The patient, F. T., colored, twenty-six years of age, living in New York City for many years, was in the hospital with the diagnosis: retroversion, endocervicitis. Her complaint was profuse discharge and occasional backache. An operation was performed for retroversion, the lacerated cervix was amputated, and the appendix giving the impression of subacute involvement was taken out. Nothing in the previous history or in the findings pointed toward an intestinal condition.

The gross appearance of the appendix was normal. Its length was 7 cm., of normal thickness, with serosa slightly injected.

The microscope showed many tubercle-like formations in all layers of the wall of the appendix. They consisted chiefly of swollen connective tissue cells and of some eosinophiles. In their center the eggs of Distoma (Schistosoma) haematobium were found. Many of the eggs were very well preserved; in one of them a typical larval stage (miracidium) was found; the contents of most of them indicated a young developing embryo. The spines were easily observed in many instances, and their characteristic outline could be distinguished without difficulty from shrinking and other artefacts. Some of the spines were polar, others were lateral. Eggs with polar spines and eggs with lateral spines were found in nearly the same microscopic field. Some of the destroyed eggs were apparently situated in small hyalinized blood vessels, probably having been caught there by their sharp spines. Some tissue reaction was present around all eggs found in the appendix. All transitions were found from intact eggs to complete destruction. The débris of the shells were partly surrounded by foreign body giant cells, while otherwise, very few giant cells were found. Delicate onion-shell-like structures marked the place where the destruction of an ovum had been completed. The shell stained distinctly with Weigert's elastic tissue stain. The situation of the eggs bore no relation to the direction of muscle fibers.

In the cervix—which showed papillary erosion—one calcified egg was found and one of the above-mentioned onion shell structures. The cervix was dissolved in antiformin but no further eggs were found.

The feces contained few eggs of Bilharzia, the urine none. There was no eosinophilia. The Wassermann reaction was positive.

The patient made an uneventful recovery and left the hospital. Her infection must date far back as the calcified egg shows. How far her abdominal organs are the seat of Bilharzia remains an open question.

Laparotomy has been followed by unexpected improvement even in very severe cases of bilharziosis. In our case Trichocephalus dispar was present in the feces but not in the appendix. A similar case from this

hospital was published a few years ago by Bailey and Bullard*. Drs. Bailey and Bullard did not find any other evidence of bilharziosis in their patient, neither did the prominent English physicians who saw the patient afterwards, but the persistent eosinophilia seemed, in my opinion, to indicate that the patient still harbored living Bilharzia somewhere in her body. Similar considerations make it improbable that the case described by Burfield was really a bilharziosis, primarily and only in the appendix. The mechanism of Bilharzia infection will hardly ever lead to an isolated appendical condition. The mature worms generally live in the portal vein and they swim upstream in the branches of the portal system towards the organs of the abdomen and especially of the pelvis. They may be more in the urinary system as is usually found in Egypt, or more in the intestine, as characteristic of the Japanese form, but their being restricted to the small area of the veins belonging to the processus vermiformis is so improbable that it ought to be proved by autopsy findings before it can be accepted. On the other hand even in severe intestinal bilharziosis the appendix may be absolutely free; Letulle has examined the appendix very carefully in such a case and the result was negative.

The question arises whether such a patient who excretes living ova with the feces constitutes a danger for other people. In city life the danger is practically nil. For the eggs, as far as our present knowledge goes, must be deposited in water, there the small larvae must find a certain intermediate host probably a snail and after having left the snail in another stage of development it enters the human body, probably through the skin while bathing. In a not well supervised camp, however, infection may be possible.

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PLACENTA PREVIA

By Edward C. Lyon, Jr., M.D.
(Junior Attending Surgeon)

TO most obstetricians there is no more alarming or more dreaded complication in obstetrics than placenta previa, or one that can prove to be so treacherous or so serious with such little warning. An early diagnosis is so seldom made, and all too often the life of both mother and baby are jeopardized before we are aware that such a condition exists. Fortunately for all concerned this condition is not of frequent occurrence. During the past five years (October, 1919, to October, 1924), there have been 2,307 confinements on the Obstetrical Division at the Woman's Hospital, and among these, but 11 cases of previa, including all varieties, or an incidence of 1 in every 209 confinements. Of these 11 cases, 2 were central previas, 2 partial, and 7 marginal.

Although there are many signs that are supposed to point to placenta previa, the usual symptom that makes one think of previa is antepartum bleeding. So important is this, that I suspect placenta previa in every case which has bleeding without pain after the fifth month. Painless bleeding in a pregnant woman should always make one think of a low placed placenta, and one should always consider this condition before examining, vaginally, a patient who has been bleeding and stopped, or one who is still bleeding slightly. It is so easy to make an immediate examination as an aid to diagnosis, yet it is more conservative and better obstetrics in these cases to refrain from a vaginal examination until one has completed all preparations for handling the case, should the examination start up or increase the bleeding. So often a vaginal examination dislodges a blood clot or opens some new sinus, and a severe hemorrhage follows. One should be entirely prepared to handle such a hemorrhage before making an examination. By this I mean, one should have right at hand and sterilized the necessary instruments for inserting gauze packing or a Voorhees' bag, and also things so arranged that the examination can be done with the proper surgical precautions. The more severe cases, those that are bleeding freely, require an immediate tamponade under the best conditions available at the moment. Here a tamponade must be done at once or the loss of blood will endanger the patient's life. It is now routine on the Obstetrical Division in every case of suspected previa, should a vaginal examination be necessary, to make such examination in the Delivery Room where all facilities are at hand. I think that you will agree with me when I say, all cases of placenta previa are best handled in a hospital and not at home. They require so

much to be done for them in a short time, that an institution offers the best opportunities and the greatest amount of assistance.

One hemorrhage, however mild, always means another, and the second may endanger the patient's life. Even under the best surroundings, temporizing after the initial bleeding, in the hope of carrying the patient nearer term, is not the most conservative treatment. Our routine on the Obstetrical Division is to induce labor as soon as the diagnosis has been made. In the 11 cases of previa occurring in the past five years, 8 cases were in labor when admitted; in the remaining 3 labor was induced as soon as the condition of previa was recognized.

For inducing labor, to me, there is no method that offers the advantages of the Voorhees' bag (a modification of the de Ribes' bag). It, first of all, acts as a tampon and controls bleeding; in addition, it stimulates contractions, and, due to its wedge shape, accomplishes a fairly rapid dilatation. I have always used the extraovular insertion of the bag, placing it in the cervix under the placenta. I have never placed the bag within the membranes or through the placenta. Being cone-shaped and filled with fluid, (usually a weak lysol solution), it forms a true hydrostatic wedge, fits the cervix and acts both as a tampon to control bleeding, and as a substitute for the bag of waters to hasten dilatation. The bag is not difficult to insert and distend, and has one of its greatest uses in cases of placenta previa.

In order to avoid the difficulty of recurrent bleeding, the progress of the labor and the pushing of the bag through the cervix must be most carefully followed. As long as the bag is firmly in the cervix, the bleeding is controlled, but the moment the bag is expelled from the cervix by the uterine contractions, the hemorrhage may recur with added violence. The progress of the bag through the cervix is easily followed by rectal examination. It is possible to determine, with but little experience with rectal examinations in labor cases, whether the bag is firmly fixed in the cervix or about to slip through, especially if the examination is made during a uterine contraction. These rectal examinations can be made at intervals, and when the bag is most of the way through the cervix, all preparations for the next step should be completed. If a small bag was at first inserted, a larger one must be put in when this first one comes out, and in this way, the cervix brought to a complete dilatation. If a large bag was used, then the patient should be prepared for delivery. Whether another bag is inserted or the patient delivered, time is the most valuable element in the situation at this point. I mean by this that everything should be in readiness for completing the next step, for should the bleeding recur, the life of both mother and baby may depend upon the promptness with which we can act. With the patient prepared and everything in readiness, the bag is gently pulled on until it slips through the cervix, then either a larger bag inserted or the patient delivered. In

6 of our 11 cases, the Voorhees' bag was used, as a tampon and dilator. Of the remaining 5, there were 2 who were delivered at once by cesarean section, 2 who had a marginal previa, and 1 who was admitted practically fully dilated. If we are dealing with a partial or complete placenta previa, delivery is best accomplished by version and breech extraction. In order, however, to deliver by this method, the cervix must have reached a dilatation sufficient to allow the hand to be passed into the uterus. A manual dilatation of the cervix at this time is contraindicated. If dilatation is not sufficient for a version, a larger bag should be inserted. A version gives us the most rapid type of delivery of course, but more important than that, if a foot is brought down, the thigh and buttock of the baby act as a tampon and control in a large measure the bleeding. As the delivery advances, the trunk, shoulders, and head are brought against the bleeding area and pressure on the open sinuses is maintained up to the time the head is delivered. In cases of partial placenta previa, the hand is passed through the membranes to bring down a foot, while in cases of complete previa, the hand is passed directly through the placenta. This of course adds a greater risk to the baby, but is, I feel, the conservative method. A foot is grasped and the buttock brought down into the cervix, which in the majority of cases controls the bleeding. Here we encounter the temptation of making a very rapid extraction of the baby. If the buttock is acting properly as a tampon and controlling the bleeding, it is best to proceed slowly, though it often requires considerable self-control to do so. A slow breech extraction is important. Only in those cases where the buttock does not control the bleeding is great speed indicated. There are two reasons for proceeding slowly. First, in most cases, at the time the version is done, the cervix has not quite reached a full dilatation; now a slow delivery will gradually complete this dilatation, and leave the cervix so open that it will not obstruct the aftercoming head. The second reason is that that portion of the cervix to which the placenta has been attached, is soft and friable and contains many large sinuses. A rapid delivery is far more apt to tear such a cervix than dilate it, with a resulting hemorrhage that may prove fatal. This second reason is very important.

On the Obstetrical Division, after the delivery of the baby, we have followed the plan of immediately removing the placenta manually, and in most cases, packing the uterus, cervix, and vagina tightly with gauze, while at the same time giving by hypodermic, the extract of pituitary gland and some hypodermic preparation of ergot. I believe a free use of pituitary extract and ergot is essential. There are a number of men who are very loath to put gauze packing in the uterus, and who obtain excellent results without a tamponade. Personally, I have not seen any case that I thought was harmed by packing, and I certainly feel much more comfortable to know the uterus, cervix, and vagina are firmly packed with gauze,—not two or three yards of gauze, but sufficient to exert firm

pressure on the sinuses in the cervix, both from within the uterus and from the vagina. If packing is used, the uterus, cervix, and vagina, all three must be firmly packed. Here I may say I have seen one patient who was not packed, who had a secondary hemorrhage a few hours later and nearly died, and another that had a secondary hemorrhage, and did die. In the 11 cases we have had, there were 5 who had a tamponade and 6 who did not. Of the 5 who were packed, 2 had a complete previa, 1 a partial and 2 a marginal; while of the 6 who were left without a tamponade, 2 were delivered by cesarean section and 4 had a marginal variety of previa.

So far, I have spoken of only the partial and complete types of previas. There remains the marginal type with the placenta placed on the lower uterine segment, and extending down to the margin of the cervix. This is the least serious, and unless there has been free bleeding, can be allowed, with careful watching, to deliver by vertex, rather than version and breech. It, as a rule, presents none of the great difficulties of the partial and complete varieties.

Also, I have not mentioned delivery by cesarean section. There is much to be said for such a procedure, if the patient is a primipara with a cervix which has not dilated beyond admitting one finger, and which is very firm, offering much resistance to dilatation with bags. In primiparae with soft crevices and in all multiparae, cesarean section is contraindicated. The disadvantage of a cesarean section is that in the event of a secondary hemorrhage, one cannot resort to a tamponade with safety. We had two cesarean sections in the 11 cases. There were 7 deliveries by breech, 5 of which followed a version; 2 were delivered as vertex cases; 1 normally and 1 with forceps; both of these were in patients with a marginal previa.

There is just one point that remains, that of transfusion. This, I feel, is extremely important. We used to treat the shock from hemorrhage in placenta previa symptomatically as conditions arose. Often the results were not as good as we wished, and at times they were absolutely bad. Now we are trying to anticipate this shock and treat it prophylactically.

For the past two years it has been routine on the Obstetrical Division at the Woman's Hospital in all cases of placenta previa to have the patient's blood typed, a donor obtained, and the blood of donor and recipient checked up. If severe bleeding has occurred, a transfusion is given at once; otherwise, when the patient is taken to the operating room for delivery, the donor is placed on a stretcher in an anteroom, prepared for transfusion. The necessary apparatus is made ready and adequate help obtained. Should any free bleeding occur during delivery, the donor is at once wheeled into the operating room and a transfusion started. We do not wait for the patient to show symptoms of shock, but start a transfusion as soon as we feel the bleeding is in any way excessive. About two years ago we lost a patient in the delivery room from hemorrhage

and shock. We did not prepare for a transfusion before the patient was in shock, and before we could start the transfusion we lost our patient. Since then both patient and donor are prepared before delivery is started, and we try to always start our transfusion before we have any of the symptoms of shock.

The more blood a patient loses, the lower the muscle tone and the less the ability of the uterus to remain contracted. Thus, we have a vicious circle on our hands. For a relaxed uterine muscle means still greater bleeding. On the Obstetrical Division we do not have any great difficulty in obtaining voluntary donors from the patient's family. The public seem to realize the importance of hemorrhage, and the great help in transfusion. It is in this way, I am convinced, that we can save patients, who would be lost if treated by the expectant treatment formerly used.

In this small series of 11 cases of placenta previa there were 3 maternal deaths:—1 immediately postpartum from shock and hemorrhage, 1 on the sixth day from peritonitis following cesarean section, and 1 on the seventeenth day from pulmonary embolism.

During the five years in which these cases occurred there were 25 maternal deaths from all causes. This gives an incidence for deaths from placenta previa of 3 in 25 or 12 per cent of our total mortality. There were 3 stillbirths, 1 baby died as a result of delivery, and 7 living babies were discharged from the hospital.

Any further analysis of so small a series is impracticable. The above figures, however, do serve a purpose in emphasizing the importance of placenta previa, and the need of being constantly on the alert in diagnosing and treating these cases.

A SERIES OF DEATHS IN GYNECOLOGIC PATIENTS*

By Ralph A. Hurd, M.D.
(Adjunct Assistant Surgeon)

A FEATURE of the weekly conference of the Woman's Hospital surgical staff is the presentation of casualty reports which include mistaken diagnoses, infections, complications, and deaths. The last item in particular is discussed in exhaustive detail and from these reports valuable suggestions as to the handling of future similar conditions are often brought out.

There can be no doubt that the case which results in a fatal outcome gives rise to more profound consideration and is often more instructive than the one which progresses smoothly to an uneventful recovery. The purpose of this study is, therefore, to determine what factors operating in these fatal cases were entirely beyond the surgeon's control and whether the patient's course might conceivably have been altered by him had the case been considered somewhat differently. The cases reviewed include 200 deaths on the gynecologic service and cover approximately 13,000 admissions. A great majority of these are in patients on the public wards although a few scattering private cases are included. This review does not consider the deaths of patients cared for by the courtesy surgeons and also omits both maternal and infant deaths on the obstetric service.

Table I

Age of Patient

UNDER 30	31 TO 40	41 TO 51	51 TO 60	OVER 60
30	31	85	24	30

Of the 200 patients under consideration all but ten underwent some sort of operative interference, although the procedures varied in extent from the intrauterine insertion of radium element under gas up to long traumatizing laparotomies under ether, consuming in some instances nearly three hours. The operations were performed by twelve surgeons, most of whom are members of the present visiting staff. A few of the simpler cases were done by the house surgeons under the close supervision of the visiting surgeons. The operating room technic and the preoperative preparation of patients are standardized here, making these factors practically identical for all the cases included.

The youngest of the patients was twenty-two years and the oldest seventy-four, while the average age of the group was forty-one.

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Age, therefore, bears about the same relation here as it would in a group of successfully operated patients and does not appear to be an important factor in the reckoning of the details.

Colored patients made up only twenty-seven of the group, approximately one-eighth of the total. This may possibly indicate that they are possessed of higher resistance, as they make up about one quarter of the complete ward census and consequently might be expected to furnish a like proportion of the mortality list. This is contrary to the prevalent idea of the higher susceptibility of the colored races to disease in general and, in view of the relatively small number of cases considered, should probably be disregarded.

All cases were carefully studied before operation according to the hospital routine, except those upon whom emergency procedures were done. In addition to this many of them had been under treatment in the out-patient department for several weeks or months before entering the hospital. Most patients who presented any problems of diagnosis had the benefit of consultations by other members of the staff. The average stay in the ward before operation was nearly a week and often it was considerably greater than this when there were fever or other symptoms warranting it. Notwithstanding the diligence with which preoperative study was carried out, mistakes did occur in some instances from failure to secure enough laboratory or other data and detrimental procedures which might have been delayed or even omitted were performed.

The general physical make-up of these patients was distinctly below that of the average type coming into the hospital. A majority were underweight while many others were correspondingly obese and presented the general picture associated with poor operability. About twenty of them might be designated unquestionably as acutely and severely ill of fulminating inflammatory disease, or of hemorrhage, while three were described by those who compiled their histories as *in extremis*. A number also presented the cachexia of advanced cancer.

Judgment as to the operability of a given case can often be condemned in a study of such a series but the surgeon who is handling the situation is in a far different position than the reviewer who has all the subsequent data before him and who knows the final outcome. A complete and accurate diagnosis in a given case is naturally always a valuable asset in outlining a proper course of treatment although it may not have a uniformly proportionate bearing on the result obtained. Although every case considered showed a fatal outcome, still the diagnosis made was an accurate one in all but about 12 per cent of the series. The approximate reckoning is given, as in some of the cases recorded as mistakes, the operator was partially right in his diagnosis.

The diagnoses on the various patients showed a large plurality of fibromyomata, many of which were associated with extensive adhesions which rendered operation technically difficult and time-consuming on account of their inaccessibility. They make up a total of seventy-one cases. Next in rank were patients in whom inflammatory disease of the adnexa and contiguous structures constituted the outstanding lesions. There were thirty of these. There were twenty-one cancer cases, some of which received only radium and others of which underwent long laparotomies for corporeal or ovarian malignancy. A similar number of patients, twenty-one, needing plastic operations are included, the group being made up of procidentias and various types of pelvic floor, cervical, and anterior vaginal wall lacerations. Next in order of frequency were twelve adherent retroversions and ten ovarian cysts, three of which had twisted pedicles. There were three cases of uncomplicated retroversion and twenty-five unclassified cases, that presented a combination of lesions or some condition not strictly gynecologic, such as postoperative ventral hernia, inoperable carcinoma of the breast, kidney lesions of various types, abdominal pregnancy, acute cholecystitis in combination with a minor pelvic condition, and several cases of therapeutic abortion for toxemia of pregnancy.

TABLE II

TYPES OF OPERATION

LAPAROTOMIES	PLASTICS	COMBINATIONS	RADIUM	MISCELLANEOUS	NONE
162	2	13	3	8	12

Patients who were not operated upon at all numbered 12 and of these four died of sepsis following induced abortion done elsewhere. There were two cases of pyelonephritis, one of which was in a single remaining kidney. The other pyelitis subject entered for an ovarian cyst operation but her kidney lesion proved to be the feature of her case. She was in a tolerably good condition on admission but gradually failed. This seemed to us a rather remarkable case as we usually encounter pyelitis as a rather mild complication, in gynecologic work, that yields readily to treatment. There were three general carcinomatosis deaths in unoperated patients, two of whom had pleuritic effusions, probably metastatic processes. There were two cases of general peritonitis which arose from an appendix abscess and a diverticulitis respectively. The last case of the twelve unoperated was a ruptured ectopic pregnancy patient who expired just as blood transfusion was being undertaken.

All the remaining patients had operations of one kind or another. There were 162 laparotomies alone, among which are those patients who had vaginal hysterectomies and in whom the peritoneal cavity was entered from below. There were thirteen patients who had both

plastic and abdominal work done while two had plastic work alone. Of the latter, one was for repair of rectocele and the other for rectocele and cystocele. It is significant that but two deaths occurred in patients who had only plastic operations in a series which covers nearly 13,000 hospital admissions. The proportion of plastic work done at the Woman's Hospital is naturally high and much of it is the fascia lapping variety which requires accurate, time-consuming work. This would tend to show therefore, that time element is not so important a factor in plastic work as it is elsewhere and the resistance to infection is considerably higher when the peritoneal cavity is not entered, whether it be from above or from below. Both the plastic cases died of pulmonary embolus after making good early recoveries. There were three cases of irradiated cervical cancer and eight other operations of various types including nephrectomies, breast amputations, induction of labor, and Percy cauterization for carcinoma.

The average operating time in the patients who had abdominal work or a combination of abdominal and plastic work was one hour and forty minutes. This is from thirty to forty minutes higher than the usual gynecologic case which does well. Many of the patients were on the table from two to two and a half hours while the longest case was a Mayo vaginal hysterectomy with repair of a large rectocele which consumed exactly three hours. It is quite likely that these patients would have fared better from the standpoint of infection had the operations been shorter since the attendant shock consequent upon long manipulation of peritoneal structures may have been a factor in lowering resistance.

TABLE III

CAUSES OF DEATH (CLINICAL DIAGNOSIS IN ABOUT 80 PER CENT)

INFECTION 1. PERITONITIS 2. SEPSIS 3. BOTH	PNEUMONIA	HEMORRHAGE	CACHEXIA OF CANCER	EMBOLISM	UNCLASSIFIED OR OBSCURE	ANESTHESIA	SHOCK
117	7	7	13	11	20	5	20

Autopsies were obtained on approximately one in six cases of this series, a fact which might appear to render the actual cause of death more or less speculative in a great majority of cases. This, however, is not the case as the clinical picture in nearly all of them is a pretty clear cut one and leaves very little to be supplied. A surprisingly large number of these patients died of infection which, at first local, went on subsequently to general sepsis. This is contrary to the prevalent conception that death in long traumatizing abdominal operations is often due to shock. It is doubtful if there were more than a dozen cases of pure shock in the series as only ten of the patients

died within twenty-four hours of leaving the operating table. To be sure there were large elements of shock in many of the patients but it seldom appeared to do more than to lower their resistance to subsequent infection.

In this connection it would seem from careful study of the individual histories that the infections arose largely from latent organisms,—staphylococci, streptococci, and bacillus coli,—which were liberated with the separation of intestinal adhesions, especially those about the sigmoid and rectum, in endeavoring to mobilize tumors or inflammatory masses deep in the pelvis. Again and again operators describe the difficulties attendant upon the manipulation of sigmoid adhesions although the gut was actually entered to gross inspection in but three cases of the series. This does not appear to be necessary for the liberation of organisms, it being obviously the serosa of the gut which acts as a barrier to further extension of microorganisms. It is very likely that a great majority of these patients who died after twenty-four hours but within ten days were cases of general sepsis, although an organism was but rarely obtained from the blood stream. It is noteworthy also that, notwithstanding the prevalence of gonorrheal infection in the pelvic organs, in only one case was the gonococcus cultured from the peritoneum and this was in a case so acute that there was a question of differential diagnosis between adnexal disease and appendicitis.

This group of cases does not bear out the teaching theory of the special danger of thrombus formation in the pelvic veins after gynecologic operations. Only ten patients showed true embolic deaths, one thirty-two days after operation. This averages little, if any, higher than is found in general surgery.

TABLE IV

DAYS LIVED AFTER OPERATION (OR AFTER ADMISSION IN UNOPERATED CASES)

2 OR UNDER	3 TO 6	7 TO 10	OVER 10
28	90	49	33

The scheme of study of these patients included a survey of their general physical make-up at time of admission, the length of observation in the out-patient department, and their hospital course as regards fever, blood pressure, various diagnoses, and laboratory findings. The operation was considered from the standpoint of the kind of anesthesia, duration, amount of hemorrhage, trauma and technical difficulties encountered, and the organisms obtained at time of operation. The postoperative course, treatment, and autopsy findings, if any, were also reviewed.

The accompanying tables present graphically the more important phases of the cases studied. It will be seen that our patients lived

from a few hours up to more than eight weeks following operation. A vast majority of them succumbed between the third and the eighth day, the average number of postoperative days being approximately five.

The methods of postoperative treatment instituted in the cases were almost entirely symptomatic and supportive. Various preparations of digitalis, strychnine, camphor, pituitary and suprarenal extracts were the drugs most frequently employed while gum glucose solution was injected intravenously and blood transfusion done in a number of cases. The percentage of unsatisfactory results obtained from the use of symptomatic treatment alone brings to mind the desirability of a specific remedial agent, chemical or serologic, to combat the infection which is so often present in these cases. The good results recently obtained by various observers with mercurochrome and other bactericides and the successful application of serum therapy to puerperal sepsis would seem to indicate definite progress along this line.

SUMMARY

1. Age appears to have but slight bearing on operative risk of gynecologic patients. This series seems to put operative resistance of colored patients somewhat higher that that of whites.

2. The general physical make-up of patients rates very high in determining the advisability of operation. Hospital residence previous to operation is undoubtedly insufficient on the average. Underweight, anemia and general asthenia should be thoroughly cared for by long rest either in hospital or in some cases in the country. Blood transfusion as a prophylactic measure should be freely used.

3. Long anesthesia is in itself without doubt a factor in lowering resistance and thereby heightening susceptibility to infection. So long as speed in operating is compatible with gentleness and accuracy it should be encouraged.

4. The surgical patient who dies after twenty-four hours and within a week to ten days will frequently show peritoneal infection and probably will have varying degrees of bacteremia. Infection was demonstrated several times at autopsy in this series where the classical signs of hectic fever, leucocytosis, etc, were absent.

5. The separation of extensive intestinal adhesions, especially about the sigmoid and rectum, in myoma operations, repeatedly resulted in subsequent peritonitis even where there was no visible gut injury. The danger of this procedure appears to be extremely high if this series of cases is a criterion.

6. Although gonorrhea is admittedly a widely debilitating affection, it was definitely fatal in only one patient of this series so far as we were able to prove.

7. There appears to be a definite need for more thorough and systematic care of patients who have undergone long traumatizing operations. Present methods are without tangible effect on peritoneal infection and its sequelae.

8. Long, technically difficult operations for tumors are often attended with varying degrees of hemorrhage and shock, thereby encouraging infection. In some of these cases it would appear that radiotherapy had better been considered more seriously.

9. Pure shock was but rarely a cause of death. Mild shock was very often a contributing cause.

10. The wisdom of routine appendectomy is to be questioned where much time has already been consumed and where the organ is inaccessible and necessitates much dissection for its removal.

11. Deaths from embolism, advanced cancer, and occasionally hemorrhage are inevitable and a practically irreducible quantity. It is conceivable, however, that the mortality in gynecologic work, low as it is, is subject to still further reduction among the large group of patients who succumb to infection following operations for extensive inflammatory disease and adherent tumors.

While the operative mortality (approximately 1.5 per cent) of all patients at the Woman's Hospital compares very favorably with similar reports from other clinics, still it is naturally one of the chief aims of the staff to see this rate further lowered. There has been definite progress along this line with a fractional decrease in the figure each year.

114 East Fifty-Fourth Street.

ABRIDGED CASE REPORTS CHOSEN AT RANDOM FROM THE SERIES

Case 1.—Postoperative hemorrhage from renal artery in a patient who had nephrectomy for pyelonephritis. Sudden collapse in 19 hours with signs of internal hemorrhage and bulging at site of wound.

Case 4.—Bad risk. Tuberculosis. Nephritis. Mild febrile course of ten weeks. Double salpingectomy for tuberculous salpingitis. Shock a large factor.

Case 8.—Supravaginal hysterectomy for densely adherent fibroid. Operation 2 hours 35 minutes. Died on fifth day of general peritonitis. Hemorrhage and shock undoubted factors in allowing latent organisms to gain hold.

Case 11.—Pulmonary embolism on the ninth day following clean rapid hysterectomy for fibroid. "Patient suddenly screamed, complained of pain in chest, and died almost immediately." Embolism probably the only factor in this case.

Case 12.—One of the few mistaken diagnoses. Thought to be cancer of corpus with resulting long tedious operation including stripping of ureters. Clinical pathology demonstrated simple follicular cyst of ovary. A shorter, simpler operation would have been curative. Misled by a suspicious metrorrhagia in a woman 46. Should all puzzling metrorrhagias at this age have a diagnostic curettment?

Case 17.—Technically difficult bilateral salpingectomy operation. Separation of many dense adhesions between tubes and lower bowel. Subsequent peritonitis and death from ileus on the tenth day. Organisms either dormant in adhesions or gained entrance directly through intestinal wall stripped of its serosa.

CASE 23.—Long tedious operation of 2 hours and 45 minutes. Plastic work and abdominal operation for retroversion. Conclusion here is that patient died from the effects of too much ether and shock dependent upon operative trauma although the operation was not technically difficult.

CASE 25.—In this case the advisability of operating so soon might be questioned. *Diagnosis:* Fibroid with complicating inflammatory disease and considerable parametritis. Admission leucocytosis of 21,000. An intermittent febrile course of 15 days although temperature was normal at time of entering. Operation long and difficult. Patient died in 20 hours of fulminating peritonitis combined with shock.

CASE 28.—A rapid clean case. Operation only 58 minutes. Supravaginal hysterectomy for fibroid. Died in 8 days of a low grade general peritonitis and parenchymatous degeneration of kidneys. One of the inevitable inexplainable deaths in surgery.

CASE 29.—Operation of 2 hours' duration with vaginal hysterectomy, fascia lapping and perineorrhaphy. Blood pressure 200/95. Woman nearly 60. Exhaustive time consuming work in an obviously poor risk case.

CASE 32.—Operation for laceration of pelvic floor, ventral suspension and appendectomy. The appendectomy by far the most difficult part of the work. Long densely adherent retrocolic appendix. Extensive dissection for its mobilization. This the only tangible source of organisms in an otherwise clean case who died subsequently of peritonitis. Question of the wisdom of removal of all appendices simply for prophylaxis in gynecologic work.

CASE 34.—One of the few cases of pure shock. Difficult 2 hours and 20 minute hysterectomy for fibroid. Tumor weighed nearly ten pounds. Considerable hemorrhage. Death within 12 hours.

CASE 35.—Extremely difficult traumatizing operation for ovarian cyst and chronic adnexal disease. Sigmoid necessarily stripped of its serosa over a wide area. Died in 4 days of sepsis following general peritonal infection encouraged by the shock of the operation.

CASE 39.—A nonoperative death. Patient died of pyelonephritis and low grade general infection. The opposite kidney had been previously removed.

CASE 41.—Operation for ectopic pregnancy 48 hours after admission. Complicating adnexal disease with leucocytosis of 13,000. General condition only fair. The question of advisability of early or delayed operation in these cases illustrated here. Died in four days of peritonitis.

CASE 45.—Rapid, clean hysterectomy for fibroid. Three days after operation patient suddenly showed signs of secondary hemorrhage severe enough to warrant immediate exploration. Laparotomy was done and after careful search the operator concluded that "no cause could be found for the physical condition of the patient." Death directly after second operation. Autopsy showed acute fibrinous peritonitis. The collapse resulting from "secondary hemorrhage" may have been an overwhelming toxemia.

CASE 46.—Interposition operation and operation for large rectocele. Blood pressure 182/100. Preoperative afebrile course of four days. Died on ninth day with temperature ranging to 103.4. Patient proved to be a poor risk although she looked well and showed nothing abnormal other than her elevated blood pressure and a rather low kidney function test.

CASE 49.—A complete hysterectomy for fibroid requiring 2 hours and 27 minutes. Tumor intraligamentous and required much trauma and hemorrhage for its removal. Possible injury to ureter as blood was obtained from bladder by catheter. Died on second day of shock and sepsis, the former probably contributing chiefly to the fatal outcome.

CASE 50.—Rapid clean hysterectomy for fibroid. Death on the fourth day from acute general peritonitis. Source of infection in this case obscure. May have entered from below by way of cervix.

CASE 53.—*Diagnosis:* Abdominal tumor, malignant. Adenocarcinoma of sigmoid encountered. Partial resection of sigmoid and enteroenterostomy. Three hours' anesthesia. Death from shock on following day.

CASE 58.—Removal of right tube for ectopic pregnancy. Died in two days of rapidly fulminating peritonitis and sepsis. Admission blood count was 11,000 white cells but patient had been afebrile five days preceding operation. Probably should have waited a longer interval.

CASE 65.—A 28 year old colored woman who was operated upon for inflammatory disease after a stay in the hospital of only five days. Death on the fifth day with a hectic temperature ranging to 103 degrees. Extremely toxic. Tympanites and other signs of general peritoneal infection. Longer observation would undoubtedly have increased her chances.

CASE 68.—This patient died on her fourth day of what appeared to be a pulmonary embolism. The operator had encountered an intraligamentous cyst which necessitated extensive blunt dissection with the probable production of widespread thrombosis of the pelvic veins. The cyst later proved to be carcinomatous although it is doubtful if this was a factor in the death.

CASE 72.—This patient was in average good condition on admission and underwent an operation for fibroid which was extremely difficult technically, resulting in much hemorrhage and consuming 2 hours and 45 minutes of operating. She died in seven hours, obviously of shock, which was contributed to by loss of blood.

CASE 73.—This patient died in five days after a rapid clean myomectomy. The temperature never rose above 102 until just before death and the pulse always averaged at 110. Postmortem showed no general peritoneal infection, the only positive finding being a "phlegmonous inflammation of myomectomy wound." It is one of the unusual types of death in the series.

CASE 77.—This patient had a hysterectomy for fibroid which took 1 hour and 50 minutes but which was described as difficult because of the low implantation of the tumors. She developed what appeared to be a low grade sepsis and was transfused twice. Promptly after the second transfusion she went into collapse and died probably of anaphylactic shock. Autopsy showed a membranous inflammation about the operative area together with albuminous degeneration of the kidney, liver and spleen.

CASE 86.—This was apparently a death from anesthesia. Patient died on the table after a few minutes' operating. The operator states his belief that the "cause of death was respiratory failure from ether."

CASE 87.—This patient was obviously a poor risk. She weighed nearly 300 pounds and presented a large ventral hernia. Kidney function was below par by the dye test and there was marked albuminuria. She was watched for five days and the blood pressure on day of operation was normal. The operation consumed 2 hours and 35 minutes. She died on the following day with suppression of urine as the outstanding symptom. "Kidneys never functioned after operation."

CASE 90.—This patient had a hysterectomy for fibroid which consumed only an hour and fifteen minutes. Many large sinuses were encountered during the operation, however, and there was a resulting large loss of blood. The hemorrhage was probably the chief factor in lowering the patient's resistance and allowing infection to take hold. She died on the eighth day of general peritonitis and sepsis.

CASE 92.—In this case again there was extensive separation of intestinal adhesions particularly about the sigmoid. Tubes and ovaries were described as indistinguishable masses and the uterus everywhere adherent. She developed a low grade infection of the peritoneum and died of intestinal obstruction in eight days.

CASE 98.—This patient had a large hemorrhagic tumor of the ovary with considerable free fluid in the peritoneum. She was acutely ill on admission with fever and a leucocytosis of nearly 12,000. After evacuation of a large quantity of fluid the patient's condition immediately became critical and she "left table in considerable degree of shock." Intravenous infusion and a number of stimulants were administered but the patient died in 10 hours. Rapid change in intraabdominal pressure in a weak patient the large factor here.

CASE 102.—This patient had a rapid clean hysterectomy and appendectomy taking only a little over an hour. Temperature mounted steadily and she died on the third day of rapidly fulminating peritonitis. A streptococcus was obtained from the peritoneum but its origin was not identified. The appendix may have been the source.

CASE 104.—This patient was operated upon for fibroid but inflammatory disease of the adnexae was encountered. Technical difficulties were met in the separation of adhesions and frank pus exuded from a lacerated tube. An overwhelming toxemia caused by rapidly spreading peritonitis resulted in death in 18 hours.

CASE 107.—The wisdom of delaying operation in adnexal disease is illustrated here. The patient was two and a half weeks in bed but even this did not prove enough. The operation for removal of both tubes was done in 56 minutes and presented no difficulties. However, cultures taken from either tube showed streptococcus and the patient died on the fifth day of general peritonitis and sepsis. She was afebrile and showed no leucocytosis for several days preceding operation.

CASE 116.—Irradiation of early cervical cancer was followed in two and a half weeks by a panhysterectomy. Patient died of peritonitis in nine days. Autopsy showed an ulcerative colitis with perforation of the gut, the result of a radium burn. This is ample cause for the infection which resulted.

CASE 124.—This patient again illustrates the danger of operative removal of large quantities of fluid from the peritoneal cavity. Although the aspiration of this large cyst was carried out very slowly the patient went into shock and died upon the table. She was in a chronic state of malnutrition from malignant disease as the clinical pathologist reported fibrosarcoma of ovary.

CASE 126.—A great many intestinal adhesions were met in this case which showed inflammatory disease and adherent retroversion. Large bleeding areas were exposed and the gut necessarily stripped of its serosa in several places. Patient died of peritonitis on the third day.

CASE 128.—A vaginal hysterectomy with fascia lapping of the anterior vaginal wall and a perineoplasty took more than 2½ hours. Death occurred in 16 hours, temperature rising to 108 degrees. This would appear to indicate that a rapid infection had taken hold, although shock was probably the chief element in so quick a death.

CASE 131.—Five weeks' observation proved insufficient in this case of inflammatory disease. Review of the findings shows that a posterior colpotomy and vaginal drainage had better been done as the operator encountered an inflammatory mass the size of a grapefruit upon entering the abdomen. Patient died almost immediately of shock which was undoubtedly aggravated by her chronic septic state. The

white blood cells had always been above 15,000 and the temperature would rise slightly with each vaginal examination.

CASE 139.—The second time in the series where sharp postoperative hemorrhage was sufficient to produce death. A myomectomy was performed, after which the patient lived only 24 hours. Inspection of peritoneum through abdominal wound showed more than a quart of fluid blood free in the cavity.

CASE 147.—A large ovarian cyst was removed and an adherent retroverted uterus suspended after two hours of extremely difficult operating which necessitated the separation of many dense intestinal adhesions. The patient died in two days apparently of fulminating sepsis, although no organism was obtained from the blood.

CASE 152.—The preoperative work-up of this patient showed a marked bacilluria and pyuria with an admission white blood count of 10,000. She was observed for two weeks and never had fever. She died in two days following a hysterectomy and autopsy revealed a streptococcic peritonitis and thick pus in both kidney pelves. The infection here was undoubtedly through the blood stream from the kidney focus and illustrates the value of clearing up all possible sources of trouble in surgical work previous to operation.

CASE 162.—Patient was obese and had a large fibroid firmly anchored deep in the pelvis. There was a complicating adnexal inflammation and she showed albuminuria and high blood pressure. The operation was necessarily long and difficult and the gut entered at one point. Infection followed and death occurred on the sixth day.

CASE 167.—A case of hyperemesis gravidarum at three months. Marked albuminuria. Leucocytosis of 14,000. "Patient profoundly toxic—on the edge of coma." Death occurred in 24 hours after curettment. Autopsy showed fatty degeneration of liver and nephritis. Uterus had better been emptied sooner.

CASE 179.—A supravaginal hysterectomy with removal of appendages and appendix requiring an hour and a half. There was much tedious painstaking dissection of dense sigmoid adhesions. Actual pus was spilled from one tube. Patient had a stormy first five days but then improved and evidently weathered the immediate effects of the operation. However, due to her lowered resistance, she developed pneumonia which proved fatal on her eighth postoperative day.

CASE 183.—This patient was operated upon as an emergency case. She was acutely ill of a ruptured tubal pregnancy and her red cells reduced to nearly 3,000,000. A thirty minutes' salpingectomy was performed but the patient died of shock and hemorrhage in 24 hours. It is difficult to speculate what would have happened had operation been deferred.

CASE 185.—A diagnosis of acute appendicitis was made here although salpingitis was considered a strong possibility. At operation flakes of fibrin were seen upon the intestine and already there were signs of general infection of the peritoneum. A gonococcus was obtained from one of the tubes. Death occurred in five days. It is quite likely that the gonococcus got into the general blood stream in this case.

CASE 195.—A leucocytosis of 13,000 was noted on the day previous to operation, although temperature was normal and patient had been under observation for 19 days. In the course of the operation at which a large tubo-ovarian abscess was encountered the patient suddenly died. She was obviously septic to begin with and operation should have been indefinitely delayed.

BLOOD PRESSURE IN OPERATIVE SURGERY AND GENERAL ANESTHESIA*

By Raymond C. Coburn, M.D.
(Anesthetist)

ALL patients operated on at the Woman's Hospital have the blood pressure taken and recorded at least three times: (1) when the physical examination is made soon after admission; (2) just prior to the administration of the anesthetic, and (3) at the completion of the operation. If it is a critical case, the blood pressure is taken at frequent intervals during the operation, and at corresponding intervals in the postoperative period. If at the first examination the blood pressure is markedly abnormal, it is taken repeatedly during the study of the case, and the lowest pressure observed during this study is considered normal for that patient unless there are attenuating circumstances.

It often takes several observations to approximate the normal level, but unless this is done the blood pressure figures may be grossly misleading. This is especially true when the patient comes to the hospital one day and is operated on the next (Table I). The nervous tension of entering the hospital and of undergoing the physical examination sends the systolic pressure of the majority of patients up from 5 to 20 mm., and the other pressures accordingly. Just prior to the administration of the anesthetic another increase is shown, which really amounts to something, from 10 to 40 mm. systolic, ordinarily, and occasionally on up to 80 and 90 mm. Here is some food for thought, in that all these patients have received a preliminary injection of morphine.

These pronounced changes in pressure are not confined to any race, color, age or class, as they occur throughout the clinic and the private cases of both the attending and the courtesy staffs.

Table I

High Blood Pressure on Day Preceding Operation

	Pulse	Respiration	Blood Pressure		Pulse Pressure
			Systolic	Diastolic	
On admission	80	20	220	120	100
Preanesthetic	70	18	198	120	78
Postoperative	76	34	116	80	36
On two occasions before admission to the hospital, pressures were			135	90	45

Operation: Hysterectomy, bilateral salpingo-oophorectomy and appendectomy.
Time: One hour and thirteen minutes. Ether anesthesia.

*Reprinted from *The Journal of the American Medical Association*, 1924, lxxxii,

On the other hand, some patients show no increase of blood pressure on admission, or before anesthesia, while others show the greatest elevation at the time of the first examination.

The reactions of the blood pressure in different individuals vary so much that the general tendency sheds no light on any particular case, but each must be examined and considered by itself.

Some regard blood pressure as the most reliable means at hand for estimating the patient's circulatory reserve, or power to withstand operative procedure. Moots' rule is followed by many in operative prognosis. It may thus be stated:

> The pressure ratio, a fraction having the pulse pressure as numerator and the diastolic pressure as denominator, may be normal between 40 and 60 per cent. If the ratio is either high or low, there is reason to apprehend danger. If the ratio lies between 25 and 75 per cent, the case is probably operable; if it is outside these limits, it is probably inoperable.[1]

Miller,[1] in checking up this rule in 1,000 cases, reports a death rate of 3.23 per cent in the operable class, and a death rate of 23.07 per cent in the probably inoperable class.

During the last institutional year of the Woman's Hospital, the attending staff performed 1,312 operations. Of these, 22 patients died, a mortality of 1.68 per cent.

Of these deaths, 4 were in the "probably inoperable" class. The time after operation and the causes of death were:

1. Five days; septicemia. (The patient evidently was infected from a virulent streptococcic pus-tube at the time of operation.)
2. Twenty-eight days; pulmonary hemorrhage.
3. Ten days; septicemia (toxic absorption from necrotic fibroid following simple drainage).
4. Thirteen days; bronchopneumonia.

It will thus be seen that, while there were deaths in this class, Motts' method of evaluation was inapplicable to them. That is, these deaths were not due to causes with which it is concerned—the patient's circulatory reserve. Nevertheless, I believe that it is a good rule to keep in mind, but only as being the point at which the caution signal should be raised. To apply it too rigidly would be to deprive a large number of the benefits of surgery that may be done with comparative safety.

Just as the majority of patients show an increase in blood pressure at the time the administration of the anesthetic is begun, so the majority of patients show a decline after anesthesia is established and the operation is well under way, especially when the nature of the operation requires full surgical anesthesia and considerable traumatism. But here, again, there is variation. Of course, those having shown the greatest preliminary rise now show the greatest fall. And when the anesthetist is dealing with a falling blood pressuse, the importance of having previously

[1]Miller, A. H.: Jour. Am. Med. Assn., Feb. 21, 1920, lxxiv, 514.

established the normal level becomes apparent, for shock does not impend until blood pressure is considerably below normal. Just how much of a real, as distinguished from the apparent, fall may be tolerated before shock develops depends on several factors, included in which are the stages of the operation, the depth of the anesthesia, and the position of the patient.

The Trendelenburg is the greatest offender of the usual positions. Care should be taken when using it. Deep anesthesia is a greater factor in lowering the blood pressure than it is generally considered. The nearer the end of the operation, the better the fall in pressure is tolerated, on account of an early cessation of traumatism and the lightening of the anesthesia. The patient showing the greatest preoperative rise in blood pressure cannot sustain a pronounced and a prolonged fall below the normal so well as patients whose blood pressure is more stable.

When the postoperative pressure shows a fall of 20 per cent below normal, with a pulse rate increased to 120 or more, the patient is in considerable depression, and should be carefully watched if not actually treated for depression. If "watchful waiting" is pursued, and the blood pressure continues to fall or the pulse to increase, most certainly special treatment should be instituted. During the operation, a somewhat greater depression may be tolerated, if not of too long duration. The color of the patient's cutaneous circulation, when uninfluenced by the administration of oxygen or by some obstruction to a free respiratory movement, is an important index of the efficiency with which the vital functions are being carried on, and should be considered in the total picture.

Blood transfusion stands at the head of the list of the means used for both the prophylactic and the restorative treatment of surgical shock and hemorrhage. However, in many cases, when serious depression occurs during or soon after the operation, blood transfusion usually is not available soon enough, for time is an all-important factor in the restorative treatment. To tide over till the patient can be typed and a donor arranged, 250 c.c. of a 6 per cent solution of gum acacia and 20 per cent glucose is introduced intravenously at the rate of 4 c.c. a minute. The solution needs to be specially prepared, and may be kept ready for emergency use.

The salient points in the gum-glucose administration are: 1. The solution must be sterile and clear. 2. It must be given slowly. 3. It must not be given in too large amounts. 4. It should reach the vein at body temperature.

Blood pressure is increased immediately on the administration of this solution, the patient becomes decidedly more pink, and there is every indication of a pronounced general improvement. The improvement is so decided that in some cases blood transfusion may not be necessary, even though it seemed imperative at the time the gum-glucose was administered. Such patients, however, must be carefully watched, for if

there is not a genuine systemic reaction the blood pressure will fall again after a few hours, and the patient will again be in a critical depression.

The use of these two means for the prophylactic and the restorative treatment of shock and hemorrhage is undoubtedly reflected in the mortality statistics herein reported. It is significant that there was not a single death in the "probably inoperable" class during the past institutional year that was due to circulatory disturbance, which is the basis of Moots' classification.

TABLE II

RECORD OF PATIENT GIVEN 250 C.C. OF GUM-GLUCOSE SOLUTION

	PULSE	RESPIRATION	BLOOD PRESSURE		PULSE PRESSURE
			Systolic	Diastolic	
On admission	120	24	112	80	32
Preanesthetic	136	24	118	98	20
Postoperative	152	36	76	64	12
5:05 P.M. (45 minutes later) gum-glucose solution started			74	64	10
6:05 P.M. gum-glucose solution finished			100	60	40
7:15 P.M.			102	60	42
9:35 P.M.			103	76	27
11:50 P.M.			104	64	40
8:30 A.M. the following day			124	74	50

Operation: Appendectomy, freeing of adhesions and enterorrhaphy. Time: One hour and twenty minutes. Ether anesthesia, rebreathing method; amount, 9¼ fluid-ounces (273 c.c.).

Attention is directed to the low postoperative systolic and pulse pressures given in Table II. A systolic pressure of 76 or less, and a pulse pressure of from 10 to 12 for more than forty-five minutes, more than fulfills the "standard requirements" for a termination by way of circulatory exhaustion. Yet this case is not at all special in its response to the treatment given (250 c.c. gum-glucose solution intravenously at the rate of 4 c.c. a minute).

While with the majority, by far, the blood pressure falls during the combined assaults of the anesthetist and the surgeon, yet there are some whose pressure rises even during prolonged major operations. The blood pressure record of such a case is shown in Table III.

This patient, aged thirty-eight, gave a history of numerous epileptic convulsions during her eighteenth year; she has had none since.

Attention is directed to the rising pulse pressure under a plentiful amount of ether and severe traumatism over a considerable time.

Another patient, who gave no history of convulsions but had a severe one just before the abdominal operation was completed, and while the patient was under deep ether anesthesia, had a similar blood pressure record. I have had three similar cases, all in adults, that is, presenting no history of convulsions before or since, but severe epileptiform convulsions near the completion of long abdominal operations, with the patients deeply anesthetized and the blood pressure increased.

When the operation is minor and the anesthesia is light, it is not uncommon for the blood pressure to rise a few millimeters during the operation; but not so in long major operations and deep anesthesia. Likewise, prolonged and deep anesthesia ordinarily suppresses convulsions even in patients subject to such seizures.

The exciting cause of these convulsions has not been determined.

TABLE III

RECORD OF PATIENT WITH HISTORY OF EPILEPSY

	PULSE	RESPIRATION	BLOOD PRESSURE		PULSE PRESSURE
			Systolic	Diastolic	
On admission	70	18	123	82	41
Preanesthetic	88	18	120	75	45
Postoperative	96	36	140	85	55

Operation: Dilation and curettage, hemorrhoidectomy, separation of adhesions, resection of right ovary, Simpson's suspension of uterus and appendectomy. Time: One hour and thirty-five minutes. Open drop ether anesthesia; amount, 13¾ fluidounces (406 c.c.).

TABLE IV

RECORD OF PATIENT WITH HIGH BLOOD PRESSURE

	PULSE	RESPIRATION	BLOOD PRESSURE		PULSE PRESSURE
			Systolic	Diastolic	
On admission	80	20	248	132	116
Preanesthetic	134	22	275	160	115
When anesthetic had been given for five minutes			320	155	165
When anesthetic had been given for 20 minutes			240	140	100
When anesthetic had been given for 30 minutes			160	90	70
When anesthetic had been given for 40 minutes	96	36	170	120	50
When anesthetic had been given for 55 minutes			174	120	54
When anesthetic had been given for 80 minutes	96	22	206	106	100
Four weeks later, when discharged from hospital			225	115	110

Operation: Supravaginal hysterectomy for fibroids and bilateral salpingo-oophorectomy. Time: One hour. Open drop ether anesthesia; amount, 9½ fluidounces (280 c.c.).

The patient, colored, aged forty-seven, whose record is given in Table IV, was kept in the hospital for six weeks under special treatment before operation. The circulatory diagnosis was hypertension, arteriosclerosis, cardiac hypertrophy and aortic insufficiency—compensation moderately impaired. There also was chronic interstitial nephritis and the Wassermann reaction was ++++.

It will thus be seen that this report includes surgery on handicapped patients.

SUMMARY

1. The majority of surgical patients show an elevation of blood pressure on entering the hospital, and a still greater increase just before the anesthetic is administered.

2. To establish the normal blood pressure often requires several observations over a period of time; but, unless the normal is established, the figures may be grossly misleading.

3. A fall in pressure usually follows deep anesthesia of some duration and severe traumatism. In the cases in which convulsions occurred, this rule was reversed.

4. The best means used for combating shock and hemorrhage were the gum-glucose solution (250 c.c. administered at the rate of 4 c.c. a minute) and blood transfusion, the former as an emergency measure.

HOW A CHAPEL BECAME A RECORD ROOM*

By Julius F. Gayler, New York
(Member, American Institute of Architects)

A NEW record room and surgical library have been installed in the Woman's Hospital, in the state of New York, using the space formerly occupied by the chapel; a room about thirty-four feet wide and fifty-seven feet long, including the altar and organ space, built in the Gothic style of architecture. The chapel had been little used of late years, because of the proximity of the Cathedral and other churches and because of the fact that the hospital does not treat chronic or medical cases and, therefore, has very few ambulatory patients. As the old record room was inadequate for the ever growing number of records, it was suggested that the chapel be transformed into a record room, reserving a portion of the room for a surgical library, space for which was much needed.

ARCHITECTURE OF CHAPEL NOT CHANGED

It was decided to leave the architecture of the chapel unchanged and to have the record cases, fittings, and furniture, of a style that would harmonize with the room. With this in view, the architect was engaged to design the record cases, exhibition cases, bookcases and memorial tablets. It was endeavored at all times to make the finished library restful, harmonious and conducive to study and research.

On either side of the entrance, as will be seen from the accompanying plan, are working spaces for the record room staff, located in the alcoves to the right and left. These spaces are provided with desks and steel cabinets for filing, and each alcove is lighted by a large window. Each of the next four alcoves, located between the record cases, also has a window. The space formerly occupied by the altar has been arranged for the surgical library.

DESIGN AFTER BOOKCASES AT OXFORD

The record cases, which contain the case histories of each patient in separate envelopes, are of oak, each twelve feet nine inches long, arranged with sliding doors and fixed shelves. The design was adopted from the bookcases in the library of the University of Oxford, Oxford, England. They are of sufficient size to accommodate the case histories for the next sixteen years. After that time, if the space is needed for new records, they will be transferred to steel cabinets in the record storeroom where they will be indexed and kept ready for reference.

*Reprinted from *The Modern Hospital*, October, 1925.

In the alcoves between the record cases there are provided oak tables and chairs for the purpose of study and research. Under the windows in these alcoves there are exhibition cases for the display of instruments, writings and drawings of historical interest to students and the medical profession. These are arranged chronologically to show the growth and development of surgery.

The surgical library alcove is provided with a large table and chairs and with open bookcases on three sides. In this alcove are kept the books and current periodicals most used in connection with the work of

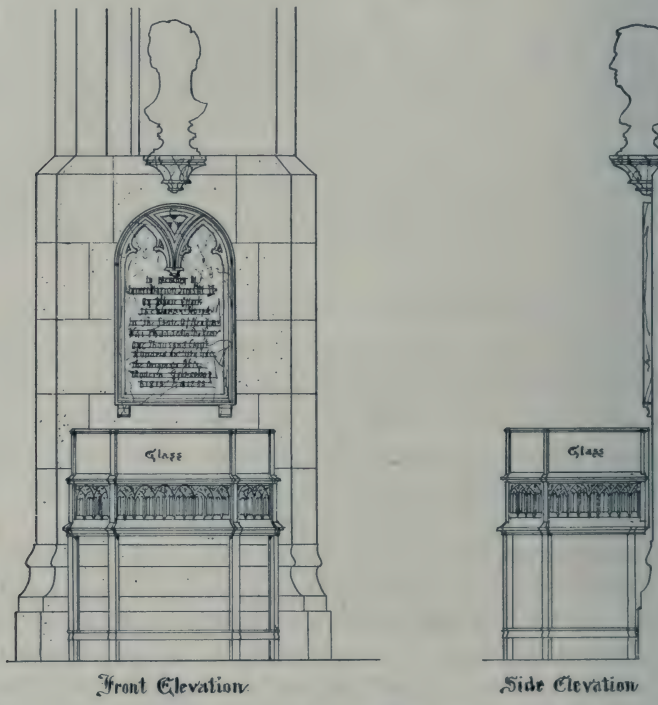


Fig. 1.

the hospital, while the rare and unusual books are kept in locked bookcases in the corners of the room.

The locker room and wash room adjoining are for the use of the record room staff.

MEMORIAL TABLETS IN SURGICAL ALCOVE

In the surgical library alcove, on the walls above the bookcases, tablets have been erected to the memory of two former vice-presidents of the hospital, Mrs. Mary Clark Thompson, wife of the late Frederick Ferris Thompson, and Mrs. Margaret Olivia Sage, wife of the late Russell Sage.

The tablet in memory of Mrs. Thompson is of Rosata marble and the one of Mrs. Sage is of Roman Travertine stone. The inscriptions on both tablets are done in lead.

Seals of the Woman's Hospital and of the American Gynecological Society have been placed in two of the windows. These are of leaded glass in the native drawing of the French leaded glass of the thirteenth century. It is the intention to have the seals of several surgical societies made up in this manner and placed in the remaining windows.

After considerable study it was found that the best method of lighting and the one most restful to the eyes, was that of incandescent lamps placed on the various tables and desks instead of general illumination from chandeliers. The dark oak ceiling precluded the possibility of "indirect lighting." A wrought iron lamp with parchment shade has

Fig. 2.—Miss Ruth H. Gayler designed the furniture in a style to harmonize with the rooms.

been placed on each table. Strong light is obtained by means of 150 watt lamps in Holophane globes, the light being concentrated on the tables and enough being transfused through the shades to provide ample light for general illumination and for the record cases.

CORNER DEDICATED TO MEMORY OF FOUNDER

In the location shown on the plan, a corner has been dedicated to the memory of Dr. James Marion Sims, through whose efforts the hospital was founded. As shown on the accompanying drawing, there will be a special exhibition case which will contain the instruments and early writings of Dr. Sims. Above that will be placed a marble tablet of especially fine Formosa marble commemorating his work for the Woman's Hospital, and stating that he was the originator of modern gynecology.

Above this tablet will be a bust of Dr. Sims made of bronze on a high elevation, supported on a bracket of Convent Sienna marble. Opposite this corner will be a tablet erected to the memory of Dr. Thomas Addis

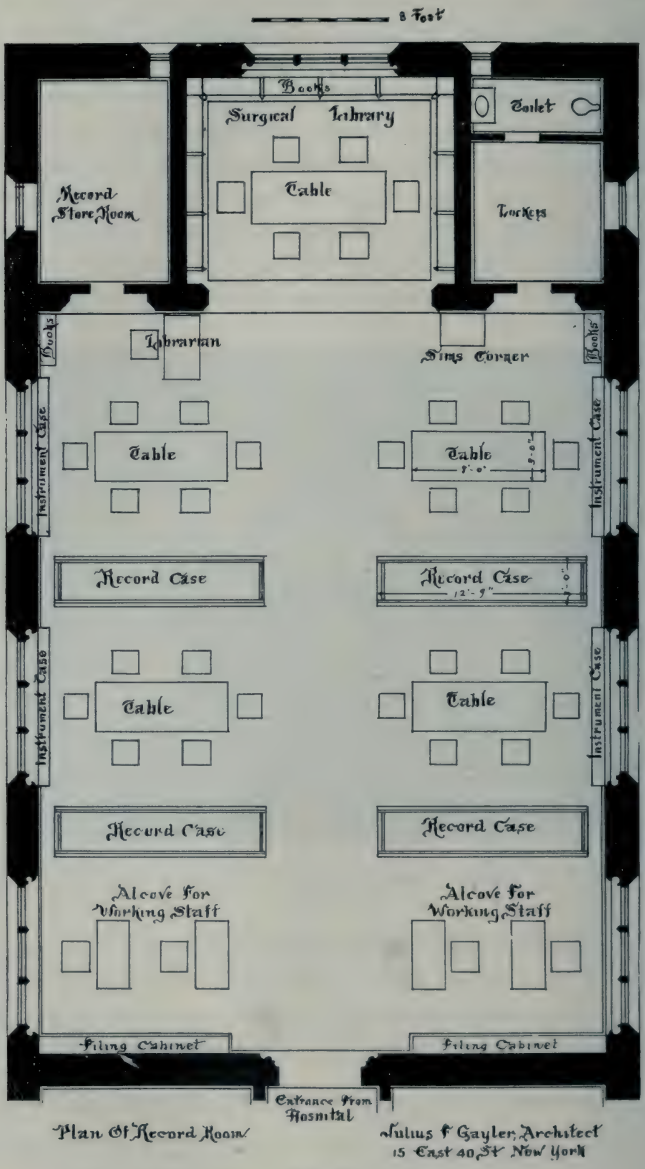


Fig. 3.

Emmet, who worked with Dr. Sims and became his successor. The governors of the hospital were glad of this opportunity to express their appreciation of Dr. Sims and Dr. Emmet and their work.

THESES CONTRIBUTED BY UNDERGRADUATE FOURTH YEAR STUDENTS AS PART OF THEIR WORK AT THE WOMAN'S HOSPITAL IN THE DEPARTMENT OF GYNECOLOGY, CORNELL UNIVERSITY MEDICAL COLLEGE SERIES 1923-1924

Students taking the elective course in gynecology are given problems as part of their work. Two students are assigned to a problem and they work up the data together, but each submits a separate thesis.

The theses here published were submitted by the first author named but the work is the result of their combined efforts.

POSTOPERATIVE LEUCOCYTOSIS*

A Study of Thirty Cases from the Wards of the Woman's Hospital of New York[1]

By Margaret S. Witter and William P. Elliott
(Fourth Year Students, Cornell University Medical College)

THERE often arise, during the course of a case, occasions when the leucocyte count is desired as an aid in the diagnosis and prognosis of postoperative events. In order critically to interpret such a postoperative count, it is necessary to have some judgment as to the average normal count after operation, and as to the limits which may be considered normal and beyond which one should be suspicious of untoward events.

Postoperative leucocytosis has been studied from many angles—the source, the causative factors, et cetera—with varying results.

It has been generally accepted that ether causes a leucocytosis, probably toxic in origin. However, DaCosta[4] found that the variations shown by the leucocyte count after ether anesthesia were irregular and not more pronounced than would be found in the same number of normal samples on different examinations. In a later paper,[5] he concluded that there was no direct relationship between duration of operation and blood disturbance or quantity of ether used. However, he does state that he found an average increase of 4,586 after ether.

Hamilton Fish[6] believed that the leucocytosis of anesthesia was phagocytic in character and a measure of individual resistance.

Cabot and his coworkers[3] seldom found a marked rise after ether, but a decided rise after operation, with a fall to a much lower figure in thirty-six hours, as follows:

	Leucocytes
After ether	7,200
After operation	27,300
After 36 hours	13,700

Cabot, therefore, concludes that, following the operative procedures, there is leucocytosis, often marked, which disappears in thirty-six hours.

Meleney,[10] in 1918, made a very thorough study of 51 noninfective, general surgical cases. He concluded that an operation performed under anesthesia, is sufficient injury to cause a marked increase in leucocytes,

*Reprinted from *Surgery, Gynecology and Obstetrics*, January, 1925, pages 23-30.

[1]This study was made as part of the work of the elective course in gynecology of Cornell University Medical College during the senior year by Margaret S. Witter and William Perry Elliott. The observations and compilation of the data were done by these students working together and the First Polk Prize in Gynecology was awarded to Dr. Witter for the best thesis.—George Gray Ward, Professor of Obstetrics and Gynecology.

and that the greatest reactions were obtained from severe trauma, many foreign bodies such as sutures, long anesthesia especially with ether, and much loss of blood.

In 1922, Scott[12] studied a series of gynecologic cases after operation, following them every first, third, fifth, etc., day. He concluded that in gynecologic cases with no history of previous infection, the postoperative leucocyte count, during certain intervals of convalescence, is practically constant. He believes that during convalescence following five common types of gynecologic operations, one can be sure in most cases, with no gross complications, of the leucocytosis at stated intervals.

Schilling[13] places blood examinations on a par with temperature, urinalysis, pulse, auscultation, and percussion. He believes it has a fundamental value in determining the status præsens, and aids not only in judgment of symptoms but throws also a vivid light on prognosis.

If we are to accord the leucocyte this high rank among our data, we must perfect our judgment of the normal leucocyte values. Therefore, it seemed to us that a study of a number of average, "clean" cases with uneventful recoveries would afford some basis for such a judgment of the normal postoperative leucocyte curve. It is the purpose of this article to present a study of 39 such cases from the wards of the Woman's Hospital in the State of New York, done under what we consider to be practically standard conditions. That is:

1. The cases were entirely from the service of Dr. George Gray Ward. They had no complicating events throughout their entire postoperative course, and were of the type considered by Dr. Ward as average, "clean" cases.

2. The preoperative preparation, the anesthesia, the operative procedures, the immediate and later postoperative care, all conformed to standard technic.

3. The counts used as data in Series I were done by M. M., an experienced technician, doing all routine counts in the hospital and using consistent technic. The counts used as data in Series II were done by W. E. and M. W., under standard conditions.

Series I

Method

Thirty cases were studied. A preoperative count was taken some time during a 1 to 3 day preoperative interval. We assumed that, under nonvarying conditions, an uninfected case should have a fairly constant count preoperatively; and we found this to be true in several cases in which daily preoperative counts were done for a week. Therefore, these counts have been charted as "pre-op," irrespective of the exact day.

Beginning with the first postoperative day, counts were then done daily for 5 to 8 days.

The counts were taken in the routine manner and counted on a double Neubauer slide, two preparations from each pipette being counted, and agreeing within a limit of ten cells.

The differential counts were, unfortunately, because of lack of time on the part of the technician, done by the counting chamber method. This method was introduced[8] by Zappert in 1892, and has been worked over by various men since as affording a quick and easy method of differential counting. However, Thro and Richards[14] believe that this method is inaccurate, especially when dealing with young polynuclear forms. Since the method is also used successfully at New York Hospital for surgical cases, we believe that it is at least clinically accurate, and has given the general direction of the differential curve, although the wide daily variation makes us feel that the method is inexact. However, since the data were compiled several months (January to May, 1923) before this analysis was undertaken there was no opportunity of change.

OBSERVATIONS

TABLE I

TOTAL LEUCOCYTE COUNTS

DAY OF COUNT	NUMBER OF CASES	MINIMUM	MAXIMUM	AVERAGE
Pre-op.	30	6000	13000	9000
1	21	12000	26000	18000
2	24	10000	27000	16000
3	28	9000	21000	13000
4	25	6000	21000	11000
5	23	7000	19000	10000
6	23	8000	19000	12000
7	18	7000	24000	13000

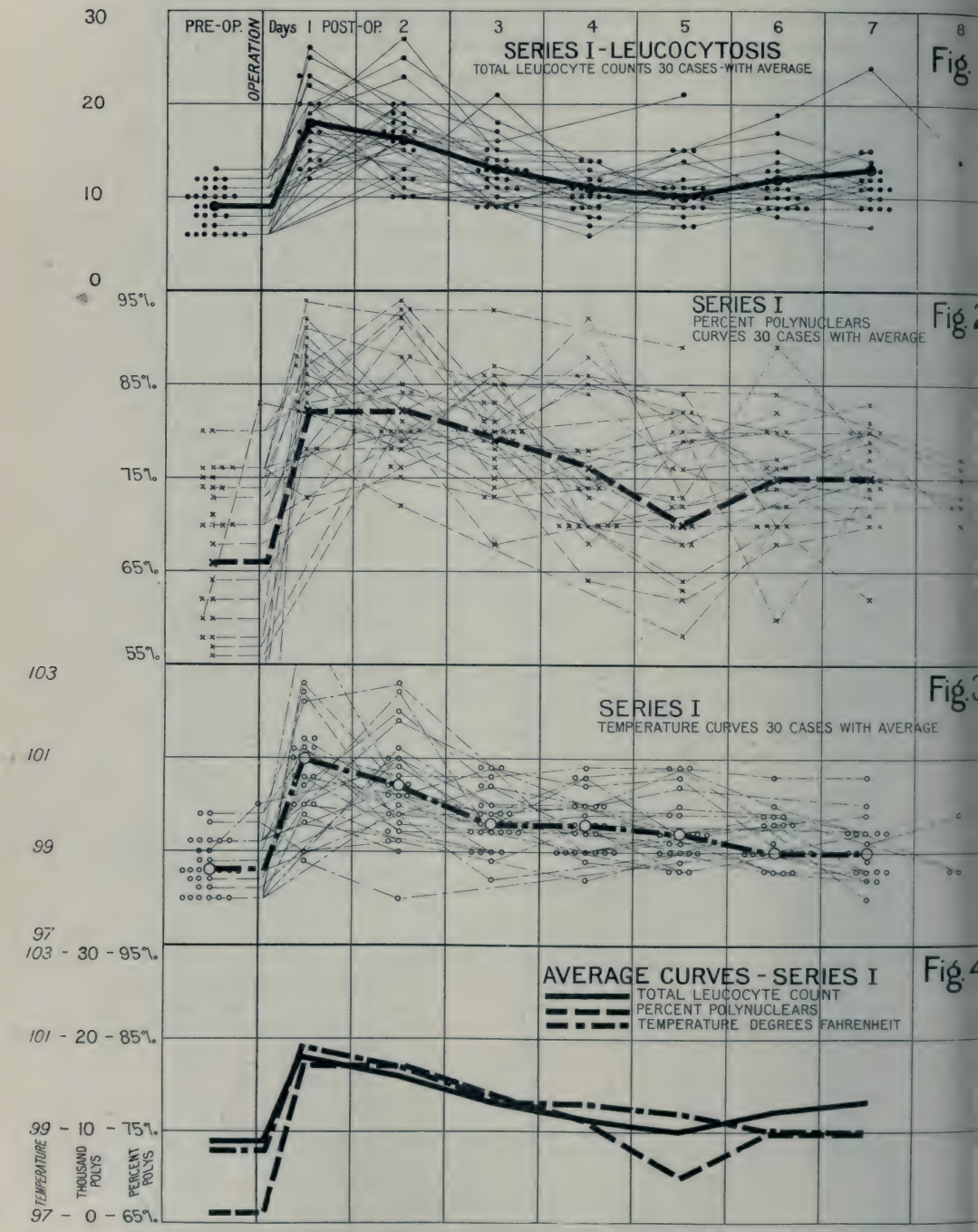
Table I shows the minimum, maximum, and average total leucocyte counts for each day with number of cases counted. The same is shown graphically in Figure 1.

TABLE II

PERCENTAGE OF POLYNUCLEARS

DAY OF COUNT	NUMBER OF CASES	MINIMUM	MAXIMUM	AVERAGE
Pre-op.	30	42	80	66
1	20	73	94	82
2	26	75	93	82
3	28	73	93	79
4	24	64	87	76
5	24	58	74	70
6	17	70	84	75
7	21	62	83	75

Table II shows the minimum, maximum, and average percentage of polynuclears for each day, with the number of cases. Graphically recorded in Figure 2.



Figs. 1, 2, 3 and 4. Composite charts of Series I showing average and range of the leucocytosis, polynuclear percentage and temperature curves in 30 nonseptic cases of abdominal section with normal convalescences.

TABLE III

TEMPERATURES (DEGREES FAHRENHEIT)

DAY OF COUNT	NUMBER OF CASES	MINIMUM	MAXIMUM	AVERAGE
Pre-op.	30	98.0	99.8	98.6
1	22	98.8	104.0	100.8
2	25	98.0	102.8	100.4
3	28	98.4	100.8	99.6
4	25	98.4	100.8	99.6
5	26	98.6	100.8	99.4
6	22	98.6	100.6	99.0
7	23	98.4	100.6	99.0

Table III shows the minimum, maximum, and average temperatures for each day, with the number of cases. Graphically recorded in Figure 3.

These three average curves are superimposed in Figure 4, to show the relationship of total leucocytes, polynuclear percentage, and temperatures.

In the graphic figures, the relationship of total leucocyte count and polynuclear percentage, is that used by Gibson[7] in his standard chart. In this, he considers 10,000 leucocytes and 75 per cent polynuclears as the normal, which, being slightly high, cares for all personal idiosyncrasies. From these up, the normal relationship is as charted. He considers an upward deviation from this normal, as, 10,000 leucocytes with 90 per cent polynuclears, as indicative of serious lesion or poor resistance. The added relationship of temperature has been assumed as being generally true, and it was found convenient for this study.

DISCUSSION

From Figure 1, we can see that there is a leucocyte curve which is highest on the first day after operation, at 18,000. It then steadily declines to normal on the fifth day (10,000), and then rises slightly on the sixth and seventh days.

The cause af this secondary rise has not been determined, or its duration. It has been suggested that the absorption of suture material at this period may be the etiologic factor.

This curve agrees with Romani[11] who found in a series of postoperative cases, that the leucocyte counts rose in a very short time and came to normal on the fifth day. Meleney[10] found normal values again on the fourth day.

The leucocytosis would seem to be mainly a polynucleosis. The preoperative differentials show a low percentage of polynuclears,—average 66 per cent—Table II. The operation is followed by a rise and the curve remains at its height for two days and descends a bit more slowly than the total leucocyte curve.

The temperature curve, likewise, Figure 3, shows its peak on the first day and descends slowly to high normal—99.0—on the sixth day. The

figure showing the average temperature curve would lead one to believe that the leucocytes and temperature bear a constant, direct relationship, but the individual charts appended show that the relationship is not so close.

Attempts were made by regrouping the cases according to the type and duration of the operations, to show other relationships between these factors and the leucocyte jump after operation. Groups were made by type of operation, and duration.

By operation:

Group 1 (9 cases, Table IV). Laparotomy: hysterectomy, salpingectomy, oophorectomy, appendectomy, retroversion; pelvic floor: rectopexy, amputation cervix, relaxed pelvic floor.

Group 2 (14 cases, Table V). Laparotomy: hysterectomy, retroversion, oophorectomy, appendectomy.

Group 3 (5 cases, Table VI). Pelvic floor plus dilatation and curettage.

Group 4 (2 cases, Table VII). Dilatation and curettage; stem pessary.

Tables IV, V, VI, and VII show the four groups and Table VIII compares their averages. We can see no significant difference in Groups 1, 2, and 3, but in Group 4 in which there was little trauma and in which each operation required but thirty minutes, there is a distinctly less marked rise than in the others.

TABLE IV

GROUP I. LAPAROTOMY AND PELVIC FLOOR. 9 CASES

	MINIMUM	MAXIMUM	AVERAGE
Preoperative	6000	13000	10000
Postoperative	14000	25000	20000
Jump	6000	15000	10000

TABLE V

GROUP 2. LAPAROTOMY. 14 CASES

	MINIMUM	MAXIMUM	AVERAGE
Preoperative	6000	12000	9000
Postoperative	12000	25000	18000
Jump	3000	14000	9000

TABLE VI

GROUP 3. PELVIC FLOOR AND DILATATION AND CURETTAGE. 5 CASES

	MINIMUM	MAXIMUM	AVERAGE
Preoperative	8000	12000	10000
Postoperative	17000	26000	22000
Jump	5000	18000	10000

TABLE VII

GROUP 4, DILATATION AND CURETTAGE, STEM PESSARY, CERVICAL POLYP.

	MINIMUM	MAXIMUM	AVERAGE
Preoperative	7000	10000	8500
Postoperative	14000	15000	14500
Jump	5000	7000	6000

TABLE VIII

AVERAGES, GROUPS 1, 2, 3, 4

	PREOPERATIVE	POSTOPERATIVE	JUMP
Group 1	10000	20000	10000
Group 2	9000	18000	9000
Group 3	10000	22000	10000
Group 4	8500	14500	6000

By time:

Group 5. 30 min. 2 cases. These are the same cases as in Group 4.

Group 6. Under 1 hour. 6 cases. Table IX.

Group 7. 1 to 2 hours. 21 cases. Table X.

Group 8. Over 2 hours. 1 case.

TABLE IX

UNDER ONE HOUR. 6 CASES

	MINIMUM	MAXIMUM	AVERAGE
Preoperative	8000	12000	10000
Postoperative	15000	25000	19000
Jump	5000	14000	8000

TABLE X

GROUP 7. ONE TO TWO HOURS. 21 CASES

	MINIMUM	MAXIMUM	AVERAGE
Preoperative	6000	13000	9000
Postoperative	12000	27000	19000
Jump	4000	19000	10000

TABLE XI

AVERAGES, GROUPS 6 AND 7

	PREOPERATIVE	POSTOPERATIVE	JUMP
Group 6	10000	19000	8000
Group 7	9000	19000	10000

We can see no significant difference between the groups. Therefore, barring our two short cases with very slight trauma, we find no significant difference in the other operations, as to duration or type of operation.

Having seen from Series I that there was a fairly constant postoperative leucocyte curve during the first week, we were interested to know when the peak of the leucocytosis occurred. From Figure 1, one would infer that the peak was one day after operation. In order to investigate this, nine cases were studied in detail.

SERIES II

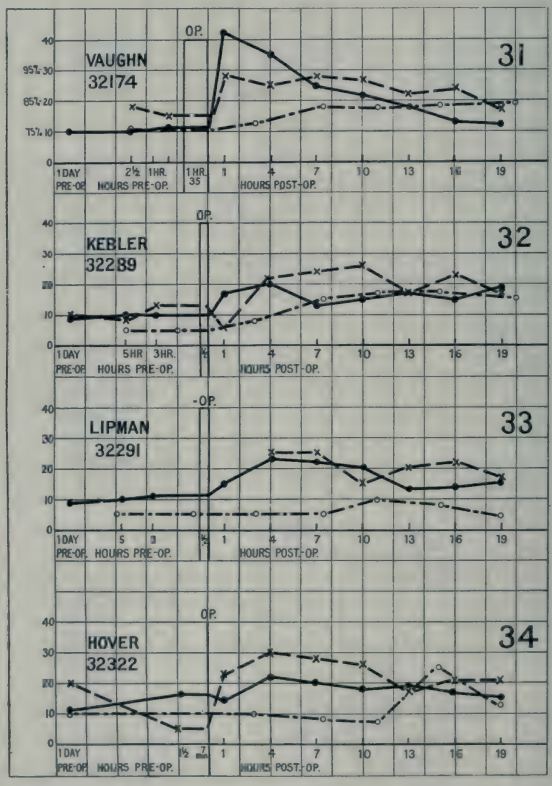
METHOD

Blood counts were done on the day preceding operation, and at 11:30 A.M., and 1:30 P.M., of the day of operation. The operation occurred from 2:30 to 4:30 P.M. A count was then done one hour after operation

and every three hours thereafter during the night. During this period, the patients were kept in the recovery room. The same methods were used as in Series I. Temperatures were taken every four hours, routinely, by the nurse.

OBSERVATIONS

Charts 31 to 39 inclusive show the results, charted in hours after operation, while charts 31A, 32A, 33A, show the curves as charted according to scale used in Series I.



Charts 31-34. Series of hourly postoperative blood counts. Total leucocyte count ————; per cent polynuclears — — — —; temperature degrees Fahrenheit — . — . — . — .

Fig. 31. The operation performed consisted in a panhysterectomy, salpingo-oophorectomy bilateral, separation of adhesions, appendectomy. The time consumed was 1 hour, 35 minutes.

Fig. 32. The operation consisted in a Kelly stitch (for incontinence) and perineorrhaphy. The time consumed was 35 minutes.

Fig. 33. Operation: Kelly for retroversion. Time: 34 minutes.

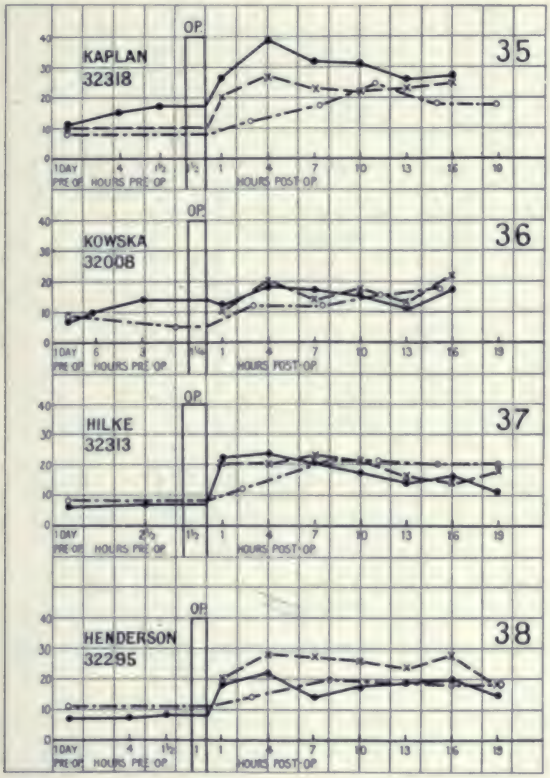
Fig. 34. Operation: dilatation and curettage. Time: 7 minutes.

In two cases, 31 and 39, there was a very high leucocytosis one hour after operation, followed by a gradual fall. In the other cases, the peak came at the fourth hour count.

The percentage of polynuclears varied in general with the leucocytosis, rising to a peak, in the majority of cases, around the fourth hour, and in all cases the peak was reached by the tenth hour.

There is, however, no close association between total leucocytes and percentage of polynuclears.

The temperature, as may be observed from the charts, does not rise synchronously with the leucocytes. In no case was the peak reached before the seventh hour after operation.



Charts 35-38. Series of hourly postoperative blood counts. Total leucocyte count ————; per cent polynuclears — — — —; temperature degree Fahrenheit — . — . — . — .

Fig. 35. Operation: dilatation and curettage, Kelly stitch, cystopexy, lacerated pelvic floor. Time: 1 hour, 23 minutes.

Fig. 36. Operation: Resection left ovary puncture of m. cyst, (1) tube and ovary, suspension ovaries; (2) separation adhesions, appendectomy. Time: 1 hour, 19 minutes.

Fig. 37. Simpson retroversion, Noble shortening of uterosacral ligament, separation adhesions, appendectomy. Time: 1 hour, 30 minutes.

Fig. 38. Operation: Lacerated pelvic floor, cystocele, rectopexy, Kelly stitch, cervical polyp. Time: 1 hour.

Table XII shows the variation by time and it is observed that the 1.5 hour group has a much greater rise than the shorter group.

TABLE XII

SERIES II GROUPED BY LENGTH OF OPERATION

TIME HOURS	JUMP		
	Minimum	Maximum	Average
0.75	6000	12000	9000
1.5	4000	21000	27000

There is some variation with the type of operation also, if one divides them as in Series I. However, it seems too slight to classify in so short a series.

DISCUSSION

TABLE XIII

SERIES II IN DETAIL

CASE NO.	PREOPERATIVE	PEAK POSTOPERATIVE	JUMP	HOUR OF PEAK	OPERATION		
					Ounces Ether	Time Hours	Procedure*
31	11000	42000	31000	1	8.5	1.5	L
32	10000	20000	10000	4	5.0	1.5	P-F
33	11000	23000	12000	4	5.25	0.5	L
34	16000	22000	6000	4	Gas	7 min.	D-C
35	16000	39000	23000	4	7.5	1.5	P-F
36	14000	18000	4000	4	Gas	1.5	L
37	6000	23000	17000	4	5.5	1.5	L
38	8000	22000	14000	4	5.5	1.0	P-F
39	17000	40000	23000	1	9.5	1.5	L

*L means laparotomy; P-F, pelvic floor operation; D-C, dilatation, curettage.

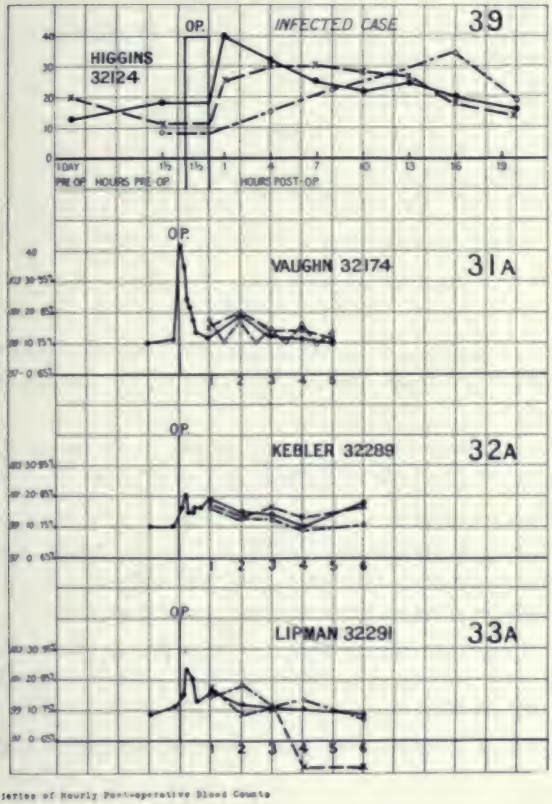
There are many factors which make this study interesting. The time element, associated with a comparable degree of trauma, is shown here as a deciding factor much more definitely than in Series I.

In the two cases which had a low jump of 4,000 and 6,000, respectively, no ether was used; while the remaining seven received from 5.5 to 9.5 ounces of ether. It would seem, therefore, that ether might be a stimulating factor.

Concentration of the blood due to preoperative preparation, and postoperative sweating, vomiting, and absence of fluid intake, etc., has been urged as a contributing factor (DaCosta). The counts of Series II would seem to point to this only as a minor factor since the counts one day preoperative, and one hour preoperative show a maximum of 5,000 rise in 2 cases and a usual rise of 1,000. Case 39 was not included in this for the rise before operation was due to a vaginal examination stirring up an infected condition. Similar rises had occurred following each vaginal examination. Very little work seems to have been done on the concentration of adult blood, but Bakwin and Morris[1] working on dehydration fever in infants, observed an increased concentration of blood plasma associated with fever, but no corresponding leucocytosis. However, it seems apparent that an average rise of over 100 per cent could not be due to concentration, since such concentration (to one-half volume), does not occur even in the most severe diarrheas.

It is of interest to note the lack of association between the temperature and leucocytosis. In all cases the rise in white cells occurred by the fourth hour, and in the temperature after the seventh hour.

It is also of interest to note that Case 39, with a history of appendiceal and pelvic abscess of one month's duration, cannot be distinguished at this period from the clean cases. Meleney found that infection had noth-



Series of Hourly Post-operative Blood Counts

Charts 39, 31A-33A. Series of hourly post-operative blood counts. Total leucocyte count ————; per cent polynuclears — — — —; temperature degrees Fahrenheit — . — . — . — .

Fig. 39. Operation: Appendectomy, enterorrhaphy, adhesions. Time: 1 hour, 35 minutes.

Fig. 31A. Operation: Panhysterectomy, salpingooophorectomy bilateral, separation of adhesions, appendectomy. Time: 1 hour, 35 minutes.

Fig. 32A. Operation: Kelly stitch (incontinence), perineorrhaphy. Time: 35 minutes.

Fig. 33A. Operation: Kelly for retroversion. Time: 34 minutes.

ing to do with the initial rise but that on the second to third day after operation, it delayed the fall.

Some authors report a rise following the administration of morphine.

Bohland[2] reports an increase from 6,386 to 13,832, six hours after 0.01 gram of morphine with a return to 7,805, nine hours after the drug was given. Leake[9] presents 4 cases with a leucopenia one hour after administration followed by a pronounced leucocytosis lasting ten hours, with a relative increase in the percentage of polynuclears. In the present series all patients received morphine about four hours after operation and then pro re nata during the night, and no attempt can be made to correlate these factors. However, the question is of interest.

We realize that 9 cases is too small a number from which to draw conclusions, but we believe that these data point the way to other studies of much interest.

SUMMARY

A series of 30 cases was studied every day after operation to show the general leucocyte curve for a week. A series of 9 cases was studied in greater detail to determine the exact form of the curve immediately after operation.

CONCLUSIONS

1. There is a leucocytosis following operation which reaches its height by the fourth hour after operation, and returns to normal by the fifth day.

2. We are led to believe that the height of the peak varies directly with the duration of operation, and extent of associated trauma produced. other factors being negligible.

3. The leucocytosis seems to be mainly a polynucleosis, the average of which compares grossly with the average total leucocyte count.

4. The temperature does not rise synchronously with the leucocytes but reaches its height several hours later. The average curve then remains grossly parallel with the leucocyte curve, but inasmuch as the temperature and leucocyte curves are not parallel in individual cases, one cannot assume that a certain temperature is constantly associated with a certain leucocytosis.

5. A further study of a larger series is necessary to correlate the various factors involved in this leucocytosis.

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THE INCIDENCE AND END-RESULTS OF CARCINOMA OF THE OVARY AT THE WOMAN'S HOSPITAL

With a Summary of the Symptoms and Physical Signs

By Charles S. Byron and Harry S. Berkoff

(Fourth Year Students, Cornell University Medical College)

IN the period between Jan. 1, 1908, and January 8, 1923, 87 cases of carcinoma of the ovary were recorded at the Woman's Hospital. This study will be limited to 82 of those cases, the remaining 5 lacking either operative or pathologic confirmation of such a condition. During that same period 29,844 cases were admitted to the Gynecological Service of the hospital, giving an incidence of 0.27 per cent for carcinoma of the ovary (Table I). There were also recorded 535 carcinoma of the cervix and 296 carcinoma of the body of the uterus, incidences of 1.8 per cent and 0.99 per cent respectively, placing carcinoma of the ovary as the least common of the more frequent genital neoplasms. Of the 2517 ovarian cystomata treated during that time, the 82 carcinomata form rather a small proportion —3.15 per cent, while the 53 cystic carcinomata in the series form a proportion of 2.1 per cent. The apparent increase in the number of cases of carcinoma of the ovary in recent years is only in keeping with the greater registration of the hospital and does not indicate a greater frequency of occurrence.

Table I

General Incidence of Carcinoma of the Ovary

Between Jan. 1, 1907, and Jan. 1, 1923

	NO. OF CASES	PER CENT
Total number of admissions	29844	
Carcinoma of ovary	82	0.27
Carcinoma of cervix	535	1.8
Carcinoma of body of uterus	296	0.99
Relation of Carcinoma of the Ovary to Ovarian Cystomata		
Number of ovarian cystomata	2517	
Carcinoma of the ovary	82	3.15
Cystic carcinoma of the ovary	53	2.1

Yearly Incidence of Carcinoma of the Ovary

1907—3 cases	1915— 3 cases
1908—0 "	1916—10 "
1909—0 "	1917—12 "
1910—1 "	1918— 7 "
1911—0 "	1919—11 "
1912—2 "	1920— 8 "
1913—4 "	1921— 7 "
1914—4 "	1922—10 "

Unfortunately, incomplete histories and poor follow-up system in the earlier days have complicated and reduced the number of cases available for this study. Only in the past few years have the records and follow-up system been complete. Where further data were needed, communication with the living patient or relatives or family physicians was of great aid. The following statistics are based on all the data that could be obtained.

TABLE II

AGE INCIDENCE OF CARCINOMA OF THE OVARY
Total Number of Cases 81

AGE	CASES	PER CENT
10-19	1	1.23
20-29	7	8.61
30-39	17	20.96
40-49	20	24.6
50-59	28	34.57
60-69	8	9.84

Youngest 19 years; Oldest 68; Average 45.9.

A perusal of Table II will reveal a distribution of occurrence of carcinoma of the ovary over six decades, 59 per cent of the total cases falling in the fifth and sixth decades. The greatest incidence lies in the fifteen year period between the ages of forty-five and sixty—53 per cent. A large proportion, approximately 31 per cent, however, occurred below the age of forty, outside the so-called cancer age. Ewing, quoting Martin's figures, states that the greatest incidence occurs in the fifth decade. In this series only one quarter of the total number of cases fell within that period, the decade of greatest incidence being the sixth, with 34.5 per cent of the cases. The youngest patient in the series was nineteen years, the oldest sixty-eight, and the average age was forty-five and nine-tenths years.

TABLE III

INCIDENCE OF FAMILY HISTORY OF MALIGNANCY
Total Number of Cases 54

	CASES	PER CENT
Positive	9	16.66
Negative	44	81.5
Possible	1	1.85

Out of 54 patients in whose records a definite family history was present, nine were positive for malignancy, a proportion of 16.6 per cent. A possible history was given in one case, in which the father of the patient had died from "chronic stomach trouble." The percentage stated above is high enough to be of significance, and bears out further the hereditary aspect of carcinoma.

TABLE IV

SOCIAL STATUS OF PATIENTS WITH CARCINOMA OF OVARY
Total Number of Cases 82

	CASES	PER CENT
Ward patients	41	50
Private patients	41	50

Fifty per cent of the patients in this series (Table IV) were private patients, which perhaps indicates a greater occurrence among the better classes. Not too much import, however, should be attached to this condition.

TABLE V

A. MARITAL STATUS OF PATIENTS WITH CARCINOMA OF OVARY
Total Number of Cases 81

	CASES	PER CENT
Single	19	23.4
Married	53	65.4
Widowed	9	11.1

B. OBSTETRICAL HISTORY IN MARRIED WOMEN WITH CARCINOMA OF THE OVARY
Total Number of Cases 44

	CASES	PER CENT
With full-term children	29	66
Never pregnant	10	22.7
Miscarriages only	5	11.3

C. INCIDENCE OF WOMEN WHO WERE NEVER PREGNANT
Total Number of Cases 54

	CASES	PER CENT
Married	10	18.5
Single	10	18.5
Total	20	37

Twenty-three per cent of the patients in this series (Table V) were single, a significant proportion. One of the married women, aged, twenty-seven, had been married only one month when she came under observation. She had, however, had symptoms and signs of a pelvic condition several months previous to marriage and might perhaps be included in the single group. Of the 44 married women in Part B of this table, 10, or 22.7 per cent had never been pregnant and 5, or 11.3 per cent had been pregnant but had never given birth to a full-term child. In Part C of Table V, 20 women (single and married) in a series of 54 cases, a proportion of 37 per cent, had never been pregnant. These statistics may be taken to suggest some ovarian dysfunction, some anatomic anomaly which later became carcinomatous, and which prevented proper functioning. This may be true especially in the light of the fact that in only one case was there found, on examination, aside from the ovarian condition, a cause for sterility. That one was a case of anteflexion. On the other hand, the

above statistics may indicate a greater susceptibility to carcinoma of the ovary, in women who have never been pregnant. I believe that single women and married women who have never been pregnant are more prone to the disease.

TABLE VI

INCIDENCE OF MENOPAUSE IN WOMEN WITH CARCINOMA OF THE OVARY
Total Number of Cases 54

	CASES	PER CENT
Menopause present	26	48.2
Menopause absent	28	51.8

Most Common Period For Occurrence of Menopause from 45 to 51 years—65.3 per cent.

Earliest—40 years; latest—56 years; average—48.8 years.

Menopause not yet Reached—Youngest age—19 years; oldest age—55 years; average age 36.3 years.

Forty-eight per cent of the patients in a series of 54 were past the menopause (Table VI). The average age at which the climacteric occurred was 48.8 years, the youngest at forty, and the oldest at fifty-six. There is not much significance in these figures, the menopause being evidently neither delayed nor occurring prematurely. The period of greatest incidence was that between forty-five and fifty-one years, quite within normal limits. Any relation that the menopause may bear to carcinoma of the ovary, is only the relation which the period, in which it commonly falls, bears to carcinoma in general.

TABLE VII

INCIDENCE OF PREVIOUS OPERATION IN WOMEN WITH CARCINOMA OF THE OVARY

PREVIOUS OPERATION
Operation for intestinal ulcer.
Dilatation and curettage.
Dilatation and curettage and trachelorrhaphy.
Dilatation and curettage and insertion of stem pessary.
Removal of ovarian teratoma.
Removal of fibroid of uterus and appendectomy.
Operation for laceration of pelvic floor.
Repair of cervix and perineum.
Operation for hernia (2 cases).
Trachelorrhaphy.

Ten patients, as shown in Table VII had had previous operations. One of these patients, a woman of thirty-two years, had had two operations. Her case is of more than passing interest. She had entered the hospital first, with a complaint of sterility, dysmenorrhea and irregular menstruation for three years. Examination at that time revealed only an anteflexed uterus. Dilatation and curettage was performed, and a stem pessary was inserted. Nine months later, the patient returned with a mass filling the pelvis. This was removed and diagnosed as an ovarian teratoma with no histologically malig-

nant process evident. Two months after discharge, she returned with a recurrent growth which was diagnosed as ovarian carcinoma. Another case had had an operation for intestinal ulcer five years previous to admission. Operation and subsequent pathologic report revealed a carcinoma of the Krukenberg type. In these two cases alone, did the previous operation suggest any etiologic factor.

TABLE VIII

DURATION OF SYMPTOMS

TOTAL NUMBER OF CASES 56	
Shortest	1 month
Longest	48 months
Average	10 months

The average duration of symptoms in 56 cases, as noted in Table VIII, was ten months. The longest forty-eight months, and the shortest one month. One of these patients had had an abdominal mass for ten years, but her active symptoms had been present for only three months. At operation a cystic carcinomatous mass was found in one ovary, while the other ovary had a benign cystoma attached to it. This latter was probably the tumor previously present. A duration of ten years has therefore not been ascribed to this case.

The most frequent symptom (Table IX) was pain in the abdomen, usually confined to the lower portion. Fifty-seven per cent of patients came in with this complaint. Swelling of the abdomen, including both the appearance of a mass or general enlargement, was almost as common. The other of the more frequent symptoms were loss of weight, weakness, metrorrhagia, backache, and frequency of urination. Despite the fact that approximately but one-half of the patients in this series had passed the menopause, it is surprising to note the relative infrequency, aside from metrorrhagia, of symptoms referable to ovarian dysfunction, notably amenorrhea and menorrhagia, the latter occurring but once, the former twice, and irregularity which occurred in only five of the cases. General symptoms of such a condition were also lacking. In summarizing, one may say that the more frequent symptoms are those referable to most malignant pelvic neoplasms and to some pelvic inflammatory conditions, but not specifically referable to the ovary.

The physical signs, however, are more definite. Fifty-six cases in the series of 58 gave evidence of either a mass in the pelvis or ascites, the former being more frequent. A mass definitely in the adnexa was ascertained in only 19 patients, approximately one-third of the cases. Although many of the patients gave evidence of loss of weight, emaciation was found in but 6. Tenderness was elicited in 14 cases, while abdominal rigidity was present in but 5. On the whole, it appears that a history of pain and swelling in the lower abdomen with

TABLE IX

INCIDENCE OF SYMPTOMS IN WOMEN WITH CARCINOMA OF THE OVARY

Total Number of Cases 63

SYMPTOM	CASES	PER CENT
Pain in the abdomen	36	57.1
Swelling of abdomen		
General enlargement	19	55.5
Mass	16	
Loss of weight	24	38.1
Weakness	17	27.
Metrorrhagia	14	22.2
Backache	12	19.
Frequency of urination	11	17.6
Constipation	11	17.6
Discharge	8	12.7
Bearing down pain	8	12.7
Headache	7	11.1
Dysuria	6	9.5
Irregularity	5	7.9
Vomiting	4	6.2
Nocturia	4	6.2
Procidentia	3	4.8
Diarrhea	3	4.8
Insomnia	2	3.1
Painful defecation	2	3.1
Amenorrhea	2	3.1
Menorrhagia	1	1.6
Incontinence of urine	1	1.6

B. INCIDENCE OF PHYSICAL SIGNS IN WOMEN WITH CARCINOMA OF THE OVARY

Total Number of Cases 58

SIGNS	CASES	PER CENT
Mass in pelvis	35	60.3
Ascites	21	36.2
Mass in adnexa	19	32.7
Tenderness in abdomen	14	24.1
Emaciation	6	10.3
Distention	6	10.3
Mass in culdesac	5	8.6
Rigidity of abdomen	5	8.6
Enlarged uterus	5	8.6
Fixed fundus uteri	4	7.
Tender adnexa	2	3.5
Deformed ant. rectal wall	2	3.5
General abdominal masses	1	1.7

loss of weight and menstrual disturbance, together with physical findings of a mass and ascites, is highly suggestive of carcinoma of the ovary.

The surgical treatment for 79 cases is set forth in Table X. Fourteen of these operations were exploratory laparotomy and removal of a specimen for pathologic diagnosis. Seventeen per cent of the cases were inoperable. Radical operation appears to have been the favorite operative procedure, supravaginal hysterectomy and panhysterectomy with bilateral salpingo-oophorectomy becoming relatively more frequent in recent years. The lesser operations in each group

TABLE X

SURGICAL TREATMENT

Total Number of Cases 79

OPERATION		CASES	PER CENT
Unilateral oophorectomy		5	6.3
Bilateral oophorectomy	7		
And unilateral salpingectomy	3	11	14.
And cecostomy	1		
Unilateral salpingo-oophorectomy	8		
And resection of broad ligament	1		
And resection of other ovary	1	12	15.1
And other salpingectomy	1		
And resection of omentum	1		
Bilateral salpingo-oophorectomy	10		
And resection of omentum	1	11	14.
Supravaginal hysterectomy			
And bilateral salpingo-oophorectomy	13		
And unilateral salpingo-oophorectomy	1	14	17.7
Panhysterectomy and bilateral salpingo-oophorectomy		10	12.6
Vaginal hysterectomy and unilateral oophorectomy		1	1.3
Exploratory laparotomy		14	17.7
Drainage of tubo-ovarian abscess		1	1.3

were performed for involvement of other structures with carcinoma or other pathologic conditions. The case in which drainage for bilateral tubo-ovarian abscess was performed was one in which the

TABLE XI

INCIDENCE OF TYPE OF PATHOLOGY

Total Number of Cases 76

TYPE		CASES	PER CENT
Carcinoma ovarii serosum		40	52.6
Unilateral	11		
Bilateral	25		
Bilateral with calcific deposits	4		
Carcinoma ovarii pseudomucinosum		13	17.
Unilateral	4		
Bilateral	9		
Carcinoma ovarii glandulare et solidum		14	18.2
Unilateral	3		
Bilateral	11		
Carcinoma ovarii primary medullary		5	6.8
Unilateral	0		
Bilateral	5		
Carcinoma ovarii secondary		4	5.2
From adenocarcinoma of uterus	2		
Unilateral	1		
Bilateral	1		
Krukenberg	2		
Unilateral	1		
Bilateral	1		

Primary Sites of Secondary Carcinoma

Stomach 2.
Uterus 2.

pelvis was filled with a necrotic purulent mass. It should perhaps be grouped with the cases of exploratory laparotomy.

By far the most frequent group of carcinoma reported was the papillary serocystic type, carcinoma ovarii serosum. This type was present in 52 per cent of the cases. Four of these exhibited calcific deposits. Next in frequency was the glandular and solid carcinoma, the adenocarcinoma of some, and almost as frequently the pseudomucinous cystic type was found. But five cases of the primary medullary carcinoma were reported. In every type the bilateral form occurred much more frequently than the unilateral form; in the primary medullary type not one unilateral growth appeared.

Only four specimens were definitely reported as being secondary, a percentage of 5.3. In none of the other cases was there any definite evidence found of a primary focus, either at operation or after gross and histologic examination of the growth. Of the four, two had metastasized from adenocarcinoma of the body of the uterus. The remaining two were of the Krukenberg type, in one of which a definite infiltration of the cardiac end of the stomach was found. The other was the case previously mentioned, in which an operation for ulcer of the intestine was performed.

One case not listed in the table was one in which the carcinoma had formed on the basis of a previous ovarian teratoma.

Metastases at operation (Table XII) were found in 50 per cent of the cases in the series of 78. The most frequent distribution was to peritoneum, next the omentum, the uterus, broad ligaments and tubes. Less commonly, the other abdominal viscera were involved. The liver was involved in 5 cases and the lymph nodes in only 3. A general carcinomatosis and skin involvement was present in but 1 case. The entire abdomen was infiltrated in 2 cases out of the 39.

The average duration of symptoms in 21 cases which showed metastases at operation in a series of 35 was 11.2 months, while for the remaining 14 cases without metastases, the average was only 4.9 months, indicating that the longer the duration of symptoms the more probable is the presence of metastases and that most cases of carcinoma of the ovary of 11 months' or more duration would probably have metastases somewhere.

According to age incidence, metastases were most frequent in the seventh decade and least frequent in the fifth. The greatest number of cases with metastases occurred in the sixth decade, 17, or 60 per cent. The smallest percentage of metastases occurred in the fifth decade.

The pathology which most frequently gave metastases was the pseudomucinous type, 61.5 per cent of which were found to have infiltrated other organs. The least frequent to metastasize was the serous type.

TABLE XII

A. INCIDENCE AND DISTRIBUTION OF METASTASIS

Total Number of Cases 78

Metastasis found in 39 cases, 50 per cent

ORGAN INVOLVED	CASES	PER CENT IN 39 CASES
Omentum	14	36.
Peritoneum	17	43.5
Uterus	10	25.6
Broad ligament	10	25.6
Tubes	8	20.4
Bladder	6	16.
Liver	5	12.8
Rectum	3	8.
Lymph nodes	3	8.
Colon	3	8.
Mesentery	2	5.1
Sigmoid	2	5.1
Intestine	2	5.1
Anterior abdominal wall	2	5.1
Entire abdomen involved	2	5.1
Stomach, pancreas, kidney, skin, carcinomatosis, in	1	2.6

B. INCIDENCE OF METASTASIS ACCORDING TO AGE

AGE PERIOD	CASES	PER CENT
10-19		
20-29	3	43.
30-39	8	47.
40-49	6	30.
50-59	17	60.
60-69	5	62.5

C. INCIDENCE OF METASTASIS ACCORDING TO DURATION OF SYMPTOMS

Total Number of Cases 35

	CASES	PER CENT	DURATION OF SYMPTOMS IN MONTHS		
			long	short	av.
With metastasis at operation	21	60	36	2	11.2
Without metastasis at operation	14	40	8	2.5	4.9

D. INCIDENCE OF METASTASIS ACCORDING TO PATHOLOGY

Total Number of Cases 33

PATHOLOGY		CASES	TOTAL CASES IN GROUP	
			Cases	Per Cent
Carcinoma ovarii serosum		15	40	37.5
Unilateral	3			
Bilateral	12			
Carcinoma ovarii pseudomucinosum		8	13	61.5
Unilateral	2			
Bilateral	6			
Carcinoma ovarii gland. et solid.		7	14	50.
Unilateral	1			
Bilateral	6			
Carcinoma ovarii prim. medullary		3	5	60.
Unilateral	0			
Bilateral	4			

TABLE XIII

A. GENERAL END-RESULTS

Total Number of Patients Traced 53, 64.6%

ALIVE AT END OF											
3 m.	6 m.	12 m.	18 m.	2 y.	3 y.	4 y.	5 y.	6 y.	7 y.	8 y.	9 y.
32	30	19	16	15	9	5	3	3	3	1	1
DIED WITHIN											
3 m.	6 m.	12 m.	18 m.	2 y.	3 y.	4 y.	5 y.	6 y.	7 y.	8 y.	9 y.
5	2	9	2	2	4	1					

Operative Mortality	16		20.3 % of 79 operations
Patients Living	12		32.5 % of 37 cases
Postoperative life			
Longest	108	months	
Shortest	6	months	
Average	46.2	months	
Patients Dead	25		67.5 % of 37 cases
(Other than operation)			
Postoperative life			
Longest	36	months	
Shortest	1	month	
Average	14.9	months	
Cause of Operative Mortality			
Shock	5	cases	
Pulmonary embolism	2	"	
General peritonitis	2	"	
Uremia	1	"	
Acute int. obstruct.	1	"	
Shock and hemorrhage	1	"	
Acute dilatation of the heart	1	"	
Fulminating sepsis	1	"	
Paralytic ileus	1	"	
Bronchopneumonia	1	"	

B. END-RESULTS ACCORDING TO DURATION OF SYMPTOMS (EXCLUDING OPERATIVE MORTALITY)

Total Number of Cases 37

	CASES	PER CENT	DURATION OF SYMPTOMS IN MONTHS	LENGTH OF LIFE IN MONTHS
Living	12	32.5		
Longest			36	108
Shortest			3	6
Average			10	46
Dead	25	67.5		
Longest			36	36
Shortest			2	1
Average			10.1	14.5

C. END-RESULTS ACCORDING TO OPERATION

Total Number of Cases 53

Patients Who Had Unilateral Oophorectomy (3 cases)

	CASES	PER CENT	TIME IN MONTHS
Postoperative life			
Living	0		
Longest			
Shortest			
Average			
Dead	1	33.3	
Longest			
Shortest			
Average			27
Operative mortality	2	66.6	

TABLE XIII—CONT'D

Patients Who Had Bilateral Oophorectomy (6 cases)

	CASES	PER CENT	TIME IN MONTHS
Postoperative life			
Living	2	33.3	
Longest			39
Shortest			5
Average			22
Dead	4	66.6	
Longest			12
Shortest			1
Average			7.5
Operative mortality	0		

Patients Who Had Unilateral Salpingo-oophorectomy (6 cases)

Postoperative life			
Living	2	33.3	
Longest			108
Shortest			11
Average			60
Dead	4	66.6	
Longest			23
Shortest			12
Average			15
Operative mortality	0		

Patients Who Had Bilateral Salpingo-oophorectomy (7 cases)

Postoperative life			
Living	0		
Longest			
Shortest			
Average			
Dead	5		
Longest			36
Shortest			6
Average			18.3
Operative mortality	2	28.5	

Patients Who Had Supravaginal Hysterectomy and Bilateral Salpingo-oophorectomy (11 cases)

Postoperative life			
Living	5	45.4	
Longest			84
Shortest			45
Average			61
Dead	1	9.1	
Longest			
Shortest			
Average			36
Operative mortality	5	45.4	

Patients Who Had Panhysterectomy and Bilateral Salpingo-oophorectomy (7 cases)

Postoperative life			
Living	3	42.8	
Longest			40
Shortest			7
Average			26
Dead	3	42.8	
Longest			26
Shortest			12
Average			17
Operative mortality	1	14.3	

TABLE XIII—CONT'D

Patients Who Had Exploratory Laparotomy (10 cases)

	CASES	PER CENT	TIME IN MONTHS
Postoperative life			
Living	0		
Longest			
Shortest			
Average			
Dead	5	50.	
Longest			26
Shortest			1
Average			7.5
Operative mortality	5	50.	

Patients Who Had Vaginal Hysterectomy and Unilateral Oophorectomy (1 case)

Postoperative life			
Dead	1	100.	17

Patients Who Had Drainage of Tuboovarian Abscess (1 case)

Operative mortality	1	100.	

D. END-RESULTS ACCORDING TO PATHOLOGY

Total Number of Cases Traced 51

Patients Who Had Carcinoma Ovarii Serosum Unilaterale (8 cases)

	CASES	PER CENT	TIME IN MONTHS
Postoperative life			
Living	3	37.5	
Longest			108
Shortest			7
Average			52
Dead	4	50.	
Longest			27
Shortest			12
Average			19
Operative mortality	1	12.5	

Patients Who Had Carcinoma Ovarii Serosum Bilaterale (18 cases)

Postoperative life			
Living	2	11.1	
Longest			72
Shortest			45
Average			59
Dead	8	44.4	
Longest			36
Shortest			3
Average			17
Operative mortality	8	44.4	

Patients Who Had Carcinoma Ovarii Pseudomucinosum Unilaterale (2 cases)

Postoperative life			
Living	0		
Longest			
Shortest			
Average			
Dead	2	100.	
Longest			17
Shortest			1
Average			8.5
Operative mortality	0		

TABLE XIII—CONT'D

Patients Who Had Carcinoma Ovarii Pseudomucinosum Bilaterale (5 cases)

	CASES	PER CENT	TIME IN MONTHS
Postoperative life			
Living	3	60.	
Longest			47
Shortest			5
Average			30
Dead	1	20.	
Longest			
Shortest			
Average			8
Operative mortality	1	20.	

Patients Who Had Carcinoma Ovarii Glandulare et Solidum Unilaterale (2 cases)

Postoperative life			
Living	0		
Longest			
Shortest			
Average			
Dead	2	100.	
Longest			17
Shortest			1
Average			8.5
Operative mortality	0		

Patients Who Had Carcinoma Ovarii Glandulare et Solidum Bilaterale (9 cases)

Postoperative life			
Living	0		
Longest			
Shortest			
Average			
Dead	3	33.3	
Longest			36
Shortest			3
Average			17
Operative mortality	6	66.6	

Patients Who Had Carcinoma Ovarii Primary Medullary Bilaterale (5 cases)

Postoperative life			
Living	3	60.	
Longest			84
Shortest			12
Average			49
Dead	2	40.	
Longest			12
Shortest			8
Average			10
Operative mortality	0		

Patients Who Had Carcinoma Ovarii Secondare, Metastatic from the Uterus (1 case)

Postoperative life			
Living	1	100.	55

Patients Who Had Carcinoma Ovarii Secondare, Metastatic from the Stomach (Krukenberg Tumor) (1 case)

Postoperative life			
Dead	1	100.	5

TABLE XIII—CONT'D

E. END-RESULTS ACCORDING TO THE PRESENCE OF METASTASIS AT OPERATION

Total Number of Cases Traced 35

Patients Who Had Metastasis (21 cases)

	CASES	PER CENT	TIME IN MONTHS
Postoperative life			
Living	4	19.	
Longest			55
Shortest			6
Average			34.8
Dead	17	81.	
Longest			36
Shortest			1
Average			13.2

Patients Who Did Not Have Metastasis at Operation (14 cases)

Postoperative life			
Living	8	57.	
Longest			108
Shortest			7
Average			52
Dead	6	43.	
Longest			36
Shortest			9
Average			19.7

As stated at the beginning of this article, a poor follow-up system in the earlier days has greatly reduced the number of cases available for study. I was able to completely trace but 53 patients in any series. Of these, 16 had died from the effects of operation, from causes listed in Table XIII, A. Since this number represents the number of deaths in 79 operations, an operative mortality of 20.3 per cent is derived, a high mortality for any operation. This is a fair indication of the generally weakened state of patients with carcinoma of the ovary. Of the remaining 37 cases, 25 are dead while 12 are still alive. Among the living, the average length of life is 46.2 months, the longest having lived nine years, the shortest six months. Among the dead, the average length of life was 14.9 months, the longest three years, the shortest one month.

A study of Table XIII A reveals the general end-results, the more graphically brought out by Fig. 1.

Most of the deaths occurred in the first year after operation. Of the 25 patients who died, 16 or 64 per cent died in the first year. In all, of the 53 patients operated upon, 32 or 60.3 per cent were dead at the end of one year, and 36 or 68 per cent at the end of two years. Only one of these patients reached the third year.

The duration of symptoms appears to have had little effect upon the end-results. In both the living and dead the average duration was approximately the same.

Despite the fact that the radical operations, the supravaginal hysterectomy and the panhysterectomy with bilateral salpingo-oophorec-

tomy have the greatest operative mortality, the proportional number of patients living after each is higher than after any of the more conservative procedures. It is surprising to note also that the operative mortality is relatively greater following the supravaginal hysterectomy than it is following the panhysterectomy. The average duration of life in the living cases is longest after the supravaginal hysterectomy with bilateral salpingo-oophorectomy. The longest individual duration of nine years, however, followed a unilateral salpingo-oophorectomy. Among the patients who have died, the longest average length of life followed bilateral salpingo-oophorectomy, with the average length of life following panhysterectomy with bilateral salpingo-oophorectomy next in duration. The longest individual duration occurred in the one patient who died following supravaginal hysterectomy with bilateral salpingo-oophorectomy. The greatest mortality followed exploratory laparotomy, 100 per cent of the 10

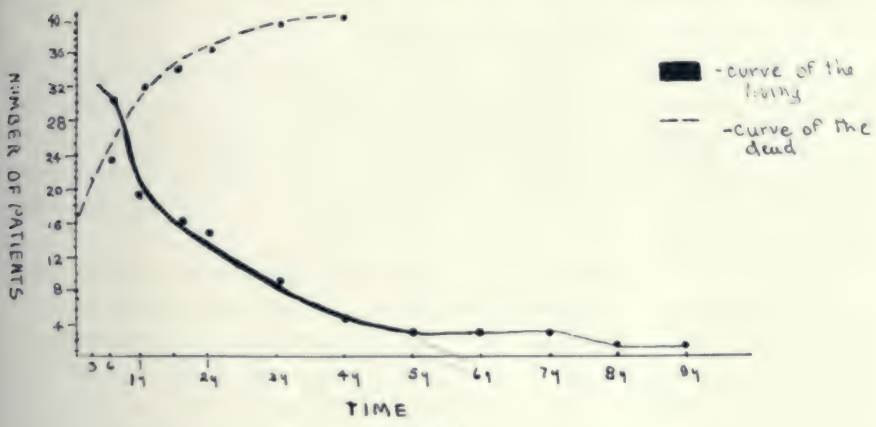

Fig. 1.

patients having died, 5 from the effects of the operation, and 5 within an average of 7.5 months, the longest case having lived 26 months. These patients, however, were late cases, in which the disease was far advanced, inoperable when the abdomen was opened and, therefore, in poor condition at the time of operation.

Among the primary carcinomata, the greatest average length of life in the living patients occurred in those with carcinoma ovarii serosum bilaterale. The average length of life in 3 cases with the unilateral type was next in order. The longest individual length of life occurred in a patient with carcinoma ovarii serosum unilaterale. She is alive nine years after operation. Among the dead, the greatest average length of life occurred in 4 patients in the series of 8 with carcinoma ovarii serosum unilaterale. The greatest individual length of life occurred in 2 patients, one with carcinoma ovarii serosum

bilaterale, the other with carcinoma ovarii glandulare et solidum. The shortest average length of life in the dead occurred in the series of 2 patients with carcinoma ovarii glandulare et solidum unilaterale. The shortest individual length of life occurred in 2 patients, one with carcinoma ovarii pseudomucinosum unilaterale, and one with carcinoma ovarii glandulare et solidum unilaterale. The greatest operative mortality occurred in patients with carcinoma ovarii glandulare et solidum bilaterale, 66 per cent of the patients having died from the effects of operation.

Of the two secondary carcinomata listed, the patient with the metastatic growth from the uterus is still alive after 55 months, the primary tumor having been removed at operation. The patient with the Krukenberg tumor, metastatic from the stomach, died within 5 months.

It is unfortunate that, aside from the data for the serous group, a larger series of cases could not have been obtained so that perhaps more accurate statistics might be compiled.

The living patients without metastasis at operation in a series of 35 cases have lived, on an average, 18 months longer than those with metastasis. Among those who have died, the patients without metastasis survived those with metastasis by 6 months. Therefore, it would seem that metastasis present at operation materially shortens the postoperative period of life.

Since this paper was written, letters have been received from two more patients, one 4 years after operation, and one 1 year after operation. Both are in good health. This increases the total number of living patients to 14. Of these, only one is known to be in poor condition, the disease having spread throughout the abdomen. Three of the patients have received x-ray radiation. How much this treatment has influenced the postoperative life, I cannot say.

It is regrettable that sufficient information has not been received regarding recurrences.

SUMMARY AND CONCLUSIONS

In the sixteen year period between January 1, 1907, and January 1, 1923, 87 cases of carcinoma of the ovary were recorded at the Woman's Hospital. For lack of pathologic or operative confirmation of this condition, five cases were not included for study. Of the 82 remaining cases, only 53 or 64.6 per cent could be traced.

1. Carcinoma of the ovary was found in 0.27 per cent of the total admissions to the Gynecological Service.

2. Carcinoma of the ovary formed a proportion of 3.15 per cent of all ovarian cystomata. The cystic carcinoma formed a proportion of 2.1 per cent of all ovarian cystomata.

3. The average age of occurrence was 45.9 years. The oldest patient was sixty-eight, the youngest nineteen years. Fifty-three per cent of the cases occurred between the ages of forty-five and sixty. Thirty-one per cent of the cases occurred below the age of forty.

4. A definite family history of malignancy was present in 16.6 per cent of the cases.

5. Fifty per cent of the cases were private patients.

6. Single women and married women who had never been pregnant, were relatively more susceptible to this disease. Single women affected formed 23 per cent of 81 cases. In a series of 54, women who had never been pregnant (single or married) formed a percentage of 37.

7. Aside from the relation between carcinoma in general and the period in which the menopause commonly occurs, no definite relation was found between carcinoma of the ovary and the menopause. The latter was neither delayed nor hastened.

8. In only two cases was there a definite etiologic factor for carcinoma of the ovary, derived from the study of previous operations. In one, an ovarian teratoma had been removed two months previous, in the other a gastroenterostomy for intestinal ulcer had been performed five years previous to the onset of the present symptoms. The latter patient had a Krukenberg tumor.

9. The average duration of symptoms was ten months, the longest forty-eight months, and the shortest one month.

10. A study of the symptoms and physical signs in this series indicate that, in any woman a history of pain and swelling or of a growing mass in the lower abdomen with loss of weight and perhaps some menstrual disturbance—together with physical findings of a mass in the pelvis, is highly suggestive of carcinoma of the ovary.

11. The most frequent type of pathology found was the carcinoma ovarii serosum, 52.6 per cent. The least frequent type among the primary tumors was the primary medullary form. In all groups the bilateral form far outnumbered the unilateral form.

12. Only four secondary carcinoma of the ovary with a definite primary focus occurred in the series, a percentage of 5.2. Two of these tumors were of the Krukenberg type.

13. Metastasis occurred in 50 per cent of the cases.

14. The most frequent sites of metastasis were, in order of frequency, the peritoneum, the omentum, uterus, broad ligaments, tubes, and bladder. The liver was involved in but five cases, the lymph nodes in but one.

15. This study indicates that the longer the duration of symptoms, the greater the probability of metastasis.

16. Metastasis was most frequent with carcinoma ovarii primary

medullary and with carcinoma ovarii pseudomucinosum. It was least common with carcinoma ovarii serosum. Metastasis was more frequent with the bilateral form in each group.

17. The longest length of life since operation of those patients who are now dead (other than operation), thirty-six months, occurred following a bilateral salpingo-oophorectomy, and in another case following a supravaginal hysterectomy and bilateral salpingo-oophorectomy.

18. The shortest length of life since operation, of those patients who are now dead (other than operation), one month, followed in one case a bilateral oophorectomy and in another an exploratory laparotomy.

19. The longest average length of life of those patients who are now dead (other than operation), 18.3 months, followed a bilateral salpingo-oophorectomy.

20. The shortest average length of life in those patients who are now dead (other than operation), 7.5 months, followed in one case a bilateral oophorectomy, and in another exploratory laparotomy.

21. The longest average length of life of those patients who are living, 61 months, followed supravaginal hysterectomy and bilateral salpingo-oophorectomy.

22. The longest individual length of life of those patients who are living, 108 months, followed unilateral salpingo-oophorectomy.

23. The greatest operative mortality followed supravaginal hysterectomy and exploratory laparotomy.

24. A greater proportion of patients are alive after supravaginal hysterectomy and bilateral salpingo-oophorectomy than following any other operative procedure.

25. The longest length of life since operation of those patients who are now dead (other than operation), 36 months, occurred in a patient with carcinoma ovarii serosum bilaterale in one case and in a patient with carcinoma ovarii glandulare et solidum in another.

26. The shortest length of life in those patients who are now dead (other than operation), occurred in one case in a patient with carcinoma ovarii pseudomucinosum bilaterale and in another with carcinoma ovarii glandulare and solidum bilaterale, one month.

27. The greatest average length of life in those patients now dead (other than operation), 19 months, occurred in a group of patients with carcinoma ovarii serosum unilaterale.

28. The shortest average length of life in those patients who are now dead (other than operation), occurred in the group of patients with carcinoma ovarii glandulare and solidum, 8.5 months.

29. The longest individual length of life in those patients now living occurred in one with carcinoma ovarii serosum unilaterale, 108 months.

30. The greatest average length of life in those patients who are

living, 52 months, occurred in a group of patients with carcinoma ovarii serosum unilaterale.

31. Patients without metastasis at operation, who are now dead, survived patients with metastasis, who are now dead, by 6 months.

32. General end-results show that

(A) Twenty per cent of the patients died from effects of operation.

(B) Of the remainder 32.5 per cent are alive, 67.5 per cent are dead.

(C) Sixty-four per cent of the patients were dead at the end of the first year following operation.

(D) The average duration of life following operation in those patients now dead (other than operative) was 14.5 months, the shortest was one month, the longest 36 months.

THE INCIDENCE OF CARCINOMA IN THE CERVIX FOLLOWING SUPRAVAGINAL HYSTERECTOMY

By Samuel S. Hochman

(Fourth Year Student, Cornell University Medical College)

CHARACTER AND EXTENT OF ORIGINAL DATA

THE object of this study is to determine the incidence of carcinoma in the cervical stump after supravaginal hysterectomy for reasons other than malignancy, with special reference to the technic employed regarding the cervix. The follow-up records of the supravaginal hysterectomies performed at the Woman's Hospital during the five years from 1918 to 1922 inclusive, were carefully reviewed for any evidence of malignancy. The histories of all the cases of carcinoma of the cervix admitted during the same period of time were also examined to see whether a supravaginal hysterectomy had been done elsewhere, prior to entrance into the Woman's Hospital. In so far as possible, information was obtained from the other hospitals and surgeons regarding the cases in question. Most of the surgeons who had done the operations here, and with whom it was possible to communicate, were personally asked whether any of their cases had subsequently developed malignancy of the cervical stump, subsequent to the operation, and what their technic regarding the cervix was.

REVIEW OF THE LITERATURE OF THE SUBJECT

A comparatively large number of cases of occurrence of carcinoma of the cervical stump has appeared in the literature, and rather extensive surveys of the subject have been made by Leonard, Currier, and Tyler. Of course, there must be a great many which have never been reported, and it is also possible that many of the cases reported are repeated in a following survey.

I have endeavored to place in Table I all the cases specifically reported, such as were done up to 1913 by Leonard. Though many of these cases are completely reported, many have been occasionally mentioned in the literature but never completely reported.

As will be seen from Table I, I have collected one hundred and twenty-one cases, all of which have been definitely mentioned in the literature. Tyler seems to have collected most of the cases, about two hundred, although he admits that there is some source of error in that some of his cases were reported by other men. By a questionnaire sent to four hundred surgeons, seventy-five cases other than those already in the literature, were referred to him.

TABLE I

AUTHOR	QUOTED BY	SUPRAVAGINAL HYSTERECTOMY FOR	TYPE OF MALIGNANCY IN CERVICAL STUMP	SUBSEQUENT DEVELOP.	REMARKS
Botzong	Leonard	Myoma uteri	Carcinoma	4 years	
Chaput		Pelvic inflam.	Carcinoma	1 yr. 3 mo.	
		Pelvic inflam.	Carcinoma	1 year	Poss. coex. Malignancy
		Pelvic inflam.	Carcinoma	6 years	
		Pelvic inflam.	Carcinoma	2 yr. 6 mo.	
Chrobak	Leonard	Myoma uteri	Carcinoma		
		Myoma uteri	Carcinoma		
		Myoma uteri	Sarcoma		
Currier		Myoma uteri	Carcinoma	8 mo.	Poss. coex. Malignancy
Fleischmann	Leonard	Myoma uteri	Carcinoma	7 years	
Freund	Leonard	Menorrhagia	Carcinoma	1 yr. 6 mo.	Poss. coex. Malignancy
Hargrave	Leonard	Myoma uteri	Carcinoma	6 months	Poss. coex. Malignancy
Jacobs	Leonard	Myoma uteri	Carcinoma	1 month	Poss. coex. Malignancy
Kaufman	Leonard	Myoma uteri	Carcinoma	4 years	
Ladinski		Myoma uteri	Carcinoma	6 months	Poss. coex. Malignancy
Leonard		Pelvic inflam.	Carcinoma	18 years	
		Pelvic inflam.	Carcinoma	3 years	
Lewis		Myoma uteri	Carcinoma	6 months	Poss. coex. Malignancy
Lempe		Pelvic inflam.	Carcinoma	18 yr. 8 mo.	
Manton		Myoma uteri	Sarcoma	3 months	Poss. coex. Malignancy
Menge	Leonard	Myoma uteri	Sarcoma	9 months	
Newman		Myoma uteri	Carcinoma	7 years	
Noble		Myoma uteri	Carcinoma	8 months	Poss. coex. Malignancy
Norris	Leonard	Myoma uteri	Carcinoma	2 years	
Olshausen	Leonard	Myoma uteri	Carcinoma	7 years	
Quenu	Leonard	Myoma uteri	Carcinoma	5 years	
Richelot		Myoma uteri	Carcinoma	6 months	Poss. coex. Malignancy
		Myoma uteri	Carcinoma	?	
		Myoma uteri	Carcinoma	3 years	
		Myoma uteri	Carcinoma	4 years	
Savor	Leonard	Myoma uteri	Carcinoma	6 years	
Schenk	Leonard	Uterine tumor	Carcinoma	5 months	Poss. coex. Malignancy
Turner		Myoma uteri	Carcinoma	8 months	Poss. coex. Malignancy
V. Ehrlach	Leonard	Myoma uteri	Carcinoma	1 year	Poss. coex. Malignancy
Wehmer	Leonard	Myoma uteri	Carcinoma	8 months	Poss. coex. Malignancy
Polak		Myoma uteri	Carcinoma	20 years	
		Myoma uteri	Carcinoma	5 years	
L. Frank		Myoma uteri	Carcinoma	1 year	Poss. coex. Malignancy
		Myoma uteri	Carcinoma	8 years	
		Myoma uteri	Carcinoma	20 years	
Vander Veer		Myoma uteri	Carcinoma	10 years	
		Myoma uteri	Carcinoma	2 years	
Freeman	Vander Veer	Myoma uteri	Carcinoma	3 years	

TABLE I—CONT'D

AUTHOR	QUOTED BY	SUPRAVAGINAL HYSTEREC-TOMY FOR	TYPE OF MA-LIGNANCY IN CERVICAL STUMP	SUBSEQUENT DEVELOP.	REMARKS
R. Frank		Myoma uteri	Carcinoma	1 year	Poss. coex. Malignancy
Woolston		Myoma uteri	Carcinoma	3 years	
Tyler		Myoma uteri	Carcinoma	6 years	
Ladinski		Myoma uteri	Carcinoma	7 months	Poss. coex.
Worral		Myoma uteri	Carcinoma	24 years	Malignancy
Davis		Myoma uteri	Carcinoma	15 years	
		Myoma uteri	Carcinoma	5 years	
		Myoma uteri	Carcinoma	2 years	
		Myoma uteri	Carcinoma	2 years	
		Myoma uteri	Carcinoma	1½ years	Poss. coex. Malignancy
		Myoma uteri	Carcinoma	9 months	Poss. coex. Malignancy
		Myoma uteri	Carcinoma	5 months	Poss. coex. Malignancy
Riotte		Myoma uteri	Carcinoma	7 years	
Riotte	Von Fellenberg	Myoma uteri	Carcinoma	20 years	
Riotte	Von Fellenberg	Myoma uteri	Carcinoma	15 years	
Riotte	Freund	Myoma uteri	Carcinoma	10 years	
Riotte	Biermer	Myoma uteri	Carcinoma	12 years	
Riotte	Freund	Myoma uteri	Carcinoma	2 years	
Jacobs		Myoma uteri	Carcinoma	1 month	Poss. coex. Malignancy
Jacobs		Myoma uteri	Carcinoma	1 month	Poss. coex. Malignancy
Jacobs		Myoma uteri	Carcinoma	6 months	Poss. coex. Malignancy
Hochman		Pelvic inflam.	Carcinoma	11 years	
Hochman		Myoma uteri	Carcinoma	4 years	
Hochman		Myoma uteri	Carcinoma	4 years	
Hochman		Myoma uteri	Carcinoma	11 months	Poss. coex. Malignancy
Hochman		Myoma uteri	Carcinoma	8 months	Poss. coex. Malignancy
Hochman		Myoma uteri	Carcinoma	3 years	Poss. coex.
Hochman		Myoma uteri	Carcinoma	7 months	Malignancy

Panhysterectomy has been advocated instead of supravaginal hysterectomy by many surgeons, notably Polak, in cases demanding the removal of the uterus. They all minimize the extra length of time with higher mortality, and consider the radical operation worth the risk, which they think is negligible, to avoid the possibility of the occurrence of future malignancy in the cervical stump. A number of series of cases help us to decide whether the risk of the more extensive operation is compensated for by future saving of life.

Bontzong, in 724 cases of supravaginal hysterectomies, from different representative European clinics, reports a primary mortality of 2.61 per cent, while in 499 cases of panhysterectomies, the mortality proved to be 6.6 per cent. Meriel, in 1910, also reported results from several clinics as follows: in 631 panhysterectomies there was a mortality of 8.2 per cent, while there was a 5.6 per cent mortality in a

CASES NOT COMPLETELY REPORTED

AUTHOR	QUOTED BY	NO CASES
Ladinski		3
Price	Frank, L.	1
Hartman	Leonard	1
Murty	Leonard	1
Le Dentu	Leonard	1
Pean	Leonard	1
Martin	Leonard	7
Savor	Von Hacken	1
Olshausen	Pawlick, Leonard	1
Batigne	Leonard	1
Condamin	Leonard	1
Krusin	Leonard	1
Hammond	Leonard	1
Bernier	Tyler	1
Lesene	Tyler	1
Noble	Tyler	1
Richardson	Tyler	1
Warnekas	Tyler	1
Weisse	Tyler	1
Saliquoix	Tyler	1
Temoin	Tyler	2
Sutton	Tyler	1
Hauser	Tyler	3
Hinterstoisser	Tyler	1
Richelot	Tyler	3
Lejan	Tyler	2
Stone	Tyler	2
Werder		4
Pinkham	Hochman	3

Total number of cases reported	121
Total number of cases completely reported	71
Supravaginal hysterectomy for myoma	62
Supravaginal hysterectomy for pelvic inflammation	7
Supravaginal hysterectomy for menorrhagia	2
Number of cases with possible coexisting malignancy at time of operation	26
Percentage of coexisting malignancy	36.6
Percentage of hysterectomies of myoma uteri	87.3

series of 601 subtotal hysterectomies. Other men get very different results in favor of the radical operation. Batigne, in a large series of cases found a mortality of 3 per cent for each operation. Bovee, in 1906, also found the two operations equal in mortality. Miller, in 1913, in a series of 9,750 supravaginal hysterectomies, reported a 4 to 5 per cent mortality, but reports from practically all other observers, give a much lower death rate. Polak, in a series of 100 supravaginal hysterectomies and 100 panhysterectomies, reports a mortality of 1.5 per cent for the former, and 2 per cent for the latter. Quillian, in a series of 214 panhysterectomies, had a mortality no higher than his supravaginal hysterectomies.

It is likely that if the occasional case of carcinoma of the cervix, developing after supravaginal hysterectomy, be added to the mortality statistics of that operation, panhysterectomy would still have a much higher mortality, according to Currier. It must be remem-

bered, moreover, that carcinoma in the vaginal vault has been known to occur after panhysterectomy for nonmalignant disease. Tyler quotes 13 such cases; Bozy, Delbet, Lejars, and Temoin, 1 each; and Quenu, and Rotier, 2 each, and Lasorbe, quoted by Monclaire, 4 cases. Faure explains the infrequency of carcinoma of the stump by the fact that it is small, atrophied, and in a state of epithelial inactivity, unfavorable to the development of carcinoma. Riotte, in reporting his case, in 1921, describes the cervix in his particular case as small, atrophied, and appearing deficient in blood supply, and evidently a poor soil for carcinoma. It is evident from Table I, that many of the cases did not develop truly, after the operation, but existed at the time. Of the seventy-one cases completely reported, twenty-six, or 36.6 per cent, had possible coexisting malignancy. Worral claims no more hemorrhage from the radical operation than the subtotal, the former taking him only thirty-five minutes in uncomplicated cases. Quillian, who does a panhysterectomy whenever circumstances permit, says that the technic may be perfected, which he describes in his own case, so that the more extensive operation is a relatively simple matter. The surgeons who have adopted a routine of a panhysterectomy instead of a supravaginal, have naturally improved their technic in that operation and very likely lower the primary mortality. From this, it may be inferred, that if the radical operation were adopted as a routine, most surgeons would have become so perfected that the total would hold no more danger than the subtotal.

Polak says that squamous cell carcinoma primarily starts from the squamous epithelium covering the mucous membrane of the vaginal portion of the cervix, while adenocarcinoma is derived from the cylindrical epithelium covering the mucosa of the canal or from that lining the glands of the cervix. He concludes that the great majority of cases of cervical cancer occur in the portio vaginalis, or just within the external os, and are squamous cell carcinoma. If the above is the case, then the point of origin is not removed by coning out the cervix. I have found that several pathologists hold the same view, and claim that the glands of the cervix are very deep, so that they would never be removed by a simple reaming out of the mucous membrane. Dougal Bissel cited a private case of his to me, on whom he had done a Strumdorf operation for a diseased and cystic cervix. The pathologist reported a small area of malignancy, deep in the cervical tissue, representing a case of very early carcinoma. He commented on the fact that a mere superficial coning out of the cervix would not have reached this area, but nevertheless, does not believe in panhysterectomy unless there is sufficient disease of the cervix at the time to warrant its removal.

Since the interval of recurrence varies so greatly from a month to

twenty-one years it is obviously impossible to tell whether malignancy will occur. However, most men today are willing to take the risk rather than undertake a panhysterectomy. The great majority of the men connected with this hospital do not believe in doing the total operation. However, Giles, who had a series of 189 cases, did not have one case of malignancy and says that "the cervical stump should give no cause for apprehension."

Tyler, although agreeing with Polak that many cases of cancer of the cervix occur at the portio vaginalis, says that the excision or cupping out of the cervical mucosa must include that portion, as Dr. Kelly has suggested the procedure also rendering easier closure to the cervix. He says that the methods most likely to prevent cancer are thorough cauterization and total hysterectomy but that the latter does not insure against it, has already been shown. The use of caustics, which may seem plausible, can promise little more than destruction of the superficial cells, leaving a deeper and more dangerous one to hypertrophy. Many claim that reaming out of the cervical mucosa has the same disadvantages, but even though superficial we must admit that many of the glands are removed by this process.

Tyler, to find out the frequency of carcinoma in the cervical stump after supravaginal hysterectomy and to determine the treatment, if any, given to the cervical mucosa, sent a questionnaire to 400 surgeons, receiving 123 replies. He found that,

Twenty-six or 22 per cent use the cautery.
Four or 3.4 per cent excise or cauterize the mucosa.
Four or 3.4 per cent prefer total hysterectomy in all cases.
Fifteen or 12.7 per cent use carbolic acid or iodine.
One or 1 per cent use curettes.
Fifty-two or 44 per cent do nothing to the mucosa.

Some thought that the destruction would prevent cancer; others that it would not prevent the squamous cell variety; others again thought that it would not have any effect on the prevention. As will be seen later, my investigations coincided in many respects with those of the above.

Quillian, before he adopted the routine of Polak, made a careful study of 25 supravaginal hysterectomies in which nothing had been done to the cervical mucosa. He observed that 20 of this series soon suffered pelvic discomfort, leucorrheal discharge, cervicitis, and endocervicitis, necessitating removal of the cervical stump. Two actually developed an epithelial carcinoma in the retained stump. From a series such as this, one would readily conclude that the cervix must be dealt with at the time of the supravaginal hysterectomy to prevent, not only future malignancy, but also annoying symptoms, such as the above. Even though such a series may be exceptional, if only ten

developed any of the above complaints, some prophylactic measures certainly would be warranted.

It is well known that carcinoma of the cervix occurs mostly in women who have borne children. Polak reports Sampson as having 421 cases of cancer of the cervix, of which more than 93 per cent were over thirty, and 97 per cent pregnant at least once. Heredity, chronic inflammatory lesions of the cervix, childbearing with resulting lacerations, and incident infection are predisposing conditions evident in all the series mentioned, and are undoubtedly of great etiologic significance. Practically all observers conclude that chronic cervical inflammation and multiparity, in a great many cases lead to carcinoma, and in these cases especially, is a most careful examination of the cervix at the time of the operation in order.

How does carcinoma develop in the cervical stump? This may occur in many ways. As cited in different instances in this article, a coexisting adenocarcinoma of the body of the uterus, which is overlooked in the operation for fibroid tumor, may be the original focus, when the cervix is secondarily invaded. This may account for a great many of the cases. A fibroid tumor may have undergone so-called carcinomatous degeneration at the time of operation, and act as a source of secondary infection of the retained cervix, which is probably rare. Thirdly, there may be an independent or coexisting carcinoma of the cervix, either of the squamous cell or the adenomatous cell type at the time of operation, which is overlooked. That such must often be the case is evident from Table I. Fourthly, carcinoma may develop in the cervical stump after supravaginal hysterectomy as a distinct entity.

The *relation of fibroids to carcinoma of the uterus and cervix* has been extensively discussed, as to whether myomata pave the way for carcinomata, or whether the two are frequently coexisting. Various authors have collected statistics regarding the frequency of carcinoma in myomatous uteri. Polak quotes Schottlander, Herbert Spencer, and Wilson. Schottlander, in 600 cases of panhysterectomy for fibroids, found undiagnosed epithelioma of the cervix in 12 of the specimens. Herbert Spencer reports 200 total hysterectomies for myomas, in which carcinoma of the cervix occurred in 2 per cent, or undiagnosed carcinoma of the cervix, which Polak says, subtotal hysterectomy would have left to kill the patient. Tully and Noble also report a 2 per cent mortality, a percentage which to some more than counterbalances the increased risk of complete extirpation. Wilson showed that carcinoma of the cervix occurs in women of from forty to fifty years, when it is most common for fibroids to produce symptoms and signs of hemorrhage and pressure. J. Henry Carstens, in a discussion of Edgar Vander Veer's paper, before the American Association of

Obstetricians and Gynecologists, in 1917, said that half of the fibroids occur in virgins with no disease of the cervix and, therefore, why do a panhysterectomy?

Louis Frank, of Louisville, reports Noble and Cullen as having 3,786 cases of myomata uteri, in which there were 124 cases of cancer, or slightly over 3 per cent; also Wilson, with 1,270 cases of fibromyomata uteri, with cancer of the cervix in 25, or about 2 per cent. He believes that uterine fibromata has something to do with the development of cancer cells of the endometrium, and extension to the cervix, and that the occurrence of cervical cancer is diminished by the plan of Howard A. Kelly of doing a supravaginal hysterectomy with removal of the cervical mucosa.

Currier quotes Piquand (*Annales de gynécologie et d'obstétrique,* July, 1905) as having collected 45 cases of myoma existing with cancer, in 24 of which it was thought that the fibromuscular elements had been transformed into epithelial cells. From Currier's experience, it seems to be much more frequent than Piquand supposed.

Noble (*Transactions of the American Gynecological Society,* 1904, p. 299), in an analysis of 1,188 cases of fibroid tumor, found 29 in which cancer of the corpus uteri was a complication, in 12 of which there was cancer of the cervix, and in 1 there was cancerous infiltration of the fibroid tumor from adenocarcinoma of the corpus uteri by metaplasia.

Jansen who had a percentage of 4.5 of cancer in 306 fibroids, Warnekros who had 78 cases of fibroid tumor and cancer in 7 of the cases, and the great majority of the investigators conclude that fibroids predispose to carcinoma. Riotte reports a series of 349 subtotal operations for myomas and 26 for other causes, making a total of 375. He found only one case of malignancy of the cervix following fibroid tumor. He also quotes Küstner in a series of 700 supravaginal hysterectomies for myomata, from 1894 to 1918, with subsequent carcinoma of the cervix in 4, and Biermer, with a series of 250 subtotal operations with 2 cervical cancers following.

In most of the series of carcinoma of the stump, after supravaginal hysterectomy, it is found that the uterus had been taken out for myoma. As seen in Table I, 63 of the 72 cases completely reported, or 88 per cent occurred after the operation for myoma. Noble, in discussing Currier's paper at the meeting of the Americal Gynecological Society, in 1906, said that fibroid tumors leading to carcinoma were enormous in number, and reported 8 per cent cancer in his last series of 100 myomata. Davis, of Boston, found that in 123 cases of cancer of the cervix, 8 or 6.5 per cent were cancer of the cervix after supravaginal hysterectomy for fibroid tumors, at the Massachusetts General Hospital in the five years from 1917 to 1921 inclusive.

TABLE II

FREQUENCY OF CARCINOMA OF THE UTERUS WITH MYOMATA

Hofmier	445	cases	of	myoma	uteri	— 17	cases	of	cancer.
Winter	753	"	"	"	"	— 23	"	"	"
Noble	1188	"	"	"	"	— 41	"	"	"
Cullen	1400	"	"	"	"	— 43	"	"	"
Total	3786					124			

Therefore, of 3,786 cases of myomata, 124 or slightly over 3 per cent had carcinoma of the corpus uteri or cervix, substantiating the conclusions of other observers that myoma must furnish influence favorable to the development of cancer.

Of 2,513 cases of myoma of the uterus reported by Krukenberg, Freundsen, Hofmier, Küstner, and Winter, 186, or 7.4 per cent, were carcinoma of the corpus uteri, in another series.

All this may not seem to be associated with the cervix, but carcinoma of the cervix is increased when associated with fibroids. Winter had 25 cases of cancer of the cervix in 1,275 cases of uterine fibroids, about 2 per cent. Richelot says that the general hypertrophy of the endometrium accompanying uterine myomata is shared by the cervical epithelium, so if the tendency to cancerous degeneration be directly attributable to active epithelial proliferation on the part of the uterine mucosa, there is sufficient grounds for the assumption that the incidence of carcinoma of the cervix would likewise be increased. The fact that nearly 75 per cent of carcinoma of the cervix occurs after supravaginal hysterectomy is a strong presumptive evidence of some definite etiologic association of the two conditions.

In a number of cases of operation for uterine fibroids, early carcinoma of the cervix has been discovered, such as the instance recited by Bissel. Cullen, also in ordinary routine examination, found the earliest squamous cell carcinoma of the cervix. Cases such as these add to our belief that where malignancy is reported subsequent to operation, it was present at the time of operation. Turner mentioned the fact that the growth may be far advanced in the cervical canal and yet there may be little abnormal on the external surface of the os.

In Table III are recorded the number of supravaginal hysterectomies performed by each division of the Woman's Hospital Service, and by surgeons not connected with any of the four divisions, for each year between 1918 and 1922 inclusive, the technic as regards the cervix by each surgeon, and whether any had had an occurrence of carcinoma in the stump.

In a series (Table III) of 1,114 hysterectomies (supravaginal, there was an occurrence of only 3 cases of malignancy of the cervical stump, or 0.27 per cent, up to the present time.

TABLE III

Total number of supravaginal hysterectomies	1114	
With coning out of the cervix	377	or 33.8 %
Carbolizing of the cervix	595	or 53.4 %
Carbolizing when there is a discharge	11	or 0.98%
Nothing done to the cervix	106	or 9.5 %
Question of what was done to the cervix	15	or 1.35%
Actual cautery to the cervix	10	or 1.98%
Total	1114	
Number of surgeons	46	
Surgeons who cone out the cervix	9	or 19.2 %
Surgeons who cauterize	1	or 2.1 %
Surgeons who carbolize	10	or 21.7 %
Surgeons who leave cervix as found	22	or 48. %
Surgeons who carbolize cervix when a discharge is present	1	or 2.1 %
Surgeons whose technic is not known	3	or 6.5 %
Surgeons who had occurrence of carcinoma of the stump	3	or 6.5 %
Surgeons who had occurrence before this series	1	or 2.1 %
Surgeons of this hospital with total occurrences	4	or 8.7 %
Occurrence of carcinoma of the stump in this series of 1114 supravaginal hysterectomies	3	or 0.27%
Occurrence of carcinoma of the stump in the operations with coning out of the cervix (1 of 377 oper.)	1	or 0.26%
Occurrence with carbolization (2 of 595 operations)	2	or 0.33%
Occurrence in this series with nothing done to the cervix	0000	
Occurrence with carbolization where discharge	0000	

Of the total number of operations, 377 had also a reaming out of the cervical mucous membrane, of which 1 or 0.26 per cent developed carcinoma of the cervical stump subsequently, this technic evidently not preventing future malignancy.

The stump and cervical canal were carbolized in 595 of the operations, and of these, 2 or 0.33 per cent developed future malignancy, proving that this technic also is no safeguard against future malignancy. However, the surgeons who use it do not hope for absolute freedom from malignancy in the future, but freedom from infection with cervicitis and endocervicitis.

During the same period of time, 1918 to 1922, all the cases of carcinoma of the cervix, excluding readmissions, of course, were reviewed for a history of a previous supravaginal hysterectomy. There were 263 new admissions, of which 7 had a positive history of a supravaginal hysterectomy for a nonmalignant condition. I say positive because in several instances, which have been excluded from this series, although the diagnosis was made clinically and pathologically of carcinoma of the cervix, further investigation proved that the operation had been a panhysterectomy or in two cases supravaginal hysterectomy for carcinoma of the uterus.

Of the above 7 cases of malignancy, 3 were operated in this hospital, and are included in the table of supravaginal hysterectomies. The remaining 4 were operated on at other hospitals and although every effort was made to secure information regarding them from their surgeons and places of operation, very little was obtained. This

TABLE IV

SUPRAVAGINAL HYSTERECTOMIES 1918-1922.

	TECHNIC	OCCUR.	1918		1919		1920		1921		1922		TOTAL	
			WARD	PRIVATE	WARD	PRIVATE	WARD	PRIVATE	WARD	PRIVATE	WARD	PRIVATE	WARD	PRIVATE
Div. 1														
1	Coned out	1												
2	Coned out	0	20	14	26	8	28	11	29	4	19	8	122	45
Div. 2														
3	Carb.	0												
4	Carb.	0												
5	Carb.	0	53	15	45	19	48	15	47	16	35	16	228	81
6	Carb.	0												
7	Carb.	0												
8	Carb.	0												
Div. 3														
9	Carb.	1												
10	Carb.	0	42	21	30	23	36	27	35	16	27	28	170	115
11	Carb.	0												
Div. 4														
12	Coned out	0												
13	Coned out	0												
14	Coned out	1 (This case carbolized.)	38	5	28	3	22	6	28	3	30	6	146	23
15	Coned out	0												
16	Coned out	0												
17	Carbol.	0										1		1
18	Coned out	0	4	2	9	1	10	2	5			5	28	10
19	0	0		3	1	2		1	1	1		2	2	9
20	0	0										1		1
21	Actual cautery						1	2	1	1		5	2	8

TABLE IV CONT'D

SUPRAVAGINAL HYSTERECTOMIES 1918-1922

	TECHNIC	OCCUR.	1918		1919		1920		1921		1922		TOTAL	
			WARD	PRIVATE	WARD	PRIVATE	WARD	PRIVATE	WARD	PRIVATE	WARD	PRIVATE	WARD	PRIVATE
22	0	0				3				1		1		6
23	0	0								1		1		2
24	0	0										1		1
25	0	3		(before 1918)			8	6	2			1	10	12
26	0	0										1		1
27	0	0		3		2	1	1	1	7		8	2	21
28	Carb. when discharge	0	3	4		2		1		1			3	8
29	0	0	2	1		1							2	2
30	0	0		1										1
31	0	0		1		1		1		1				4
32	0	0	1			1		1					1	2
33	0	0		3			2	2					2	5
34	0	0	1			1				1			1	2
35	0	0	1										1	
36	?	?		2		1		1		1				5
37	0	0		1		1	2		1				3	2
38	?	?		1		2		1	2	3			2	7
39	?	?		1										1
40	0	0				1		3	1	1			1	5
41	0	0				1			1				1	1
42	Cones out	0				1								1
43	0	0								2				2
44	0	0								1				1
45	0	0								1				1
46	0	0								1				1
													Total 727	387
													Grand Total 1114	

shows a deplorable lack of efficiency in records on the part of the surgeons and hospitals in question.

Cases Cancer of Cervix	Previous Supravaginal Hysterectomy	Percentage
263	7	2.66 %
	Compared with	
Supravaginal Hysterectomy	Subsequent Carcinoma	Percentage
1114	3	0.27 %

The following are the case reports (seven):

Case 1.—S. J., aged sixty, admitted June 9, 1921 for the second time. On December 22, 1909, patient was operated upon at the Woman's Hospital for double salpingitis, purulent, with an enlarged uterus. Supravaginal hysterectomy, bilateral salpingectomy, and appendectomy were performed and the patient made an even recovery. The stump of the cervix was carbolized. (Since then the same surgeon cones out the mucous membrane instead of carbolizing.) There was a slight infection of the cervix.

Pathologic Report.—Uterus measures 8 by 4 by 3 cm. Uterine mucosa shows few glands, tubes thickened, mucosa infiltrated with polynuclear cells. Appendix thickened. History on second admission. No marital history known; she has not menstruated for sixteen years. Patient complained of bloody discharge from the stump of the cervix, which had existed for two weeks.

Examination showed the stump of the cervix the site of bleeding polypoid projections, with a large amount of secretion. Radium inserted, 26.24 mg. for fourteen hours at the base of both broad ligaments, and tube of 50.68 mg. into the cervix for twenty-four hours, total of 1715.08 mg. hours.

Pathologic Report.—Scant amount of mucous membrane and blood, polypoid hyperplastic cervical mucosa. Evidently, as her surgeon states, he missed the carcinomatous material for the patient died not long after of extensive carcinomatous involvement of the surrounding tissues.

Case 2.—A. B., aged thirty-six, married ten years, was admitted for the second time on April 24, 1922. On May 20, 1921, a supravaginal hysterectomy was performed at the Woman's Hospital for a large fibroid tumor. The cervix at that time was freely movable; there was a small nodule in the anterior wall and an erosion with profuse brownish discharge was present. The stump was carbolized according to the routine of the surgeon.

Pathologic Report.—Fibromatous nodules up to 6.5 cm. in diameter, nodules subserous, submucous, and intramural. One shows a hemorrhagic, partly necrotic cavity. Uterine cavity normal.

Microscopic Examination.—Large areas of hemorrhage and necrosis with inflammatory reaction. No indication of malignancy seen. At follow-up clinic, April 10, 1922, badly inflamed, eroded cervix noted for the first time.

Pathologic Report.—Epidermoid carcinoma of the cervix, alveolar form.

On admission to the hospital, cervix was noted as hard, restricted from behind, bleeding and eroded. The general condition was good and the only complaint was a slight watery, white discharge since the operation. Radium inserted and patient discharged in same condition as on admission.

She was readmitted for the third time October 9, 1922. Follow-up clinic on October 4, reported loss of weight for two months, some bleeding and the disease infiltrating the left vaginal vault; watery discharge still present, and severe pain in the vagina. Radium was inserted and the patient discharged with the same symptoms. Readmitted for the fourth time on December 14, 1922, com-

plaining of profuse hemorrhage for a day, no cessation of offensive discharge, and aching pain in the abdomen since the insertion of radium in October. Examination showed a large sloughing crater at the former site of the cervix. Ten per cent silver nitrate was applied, but no packing. Discharged relieved of most of her symptoms and physical condition fair. Last follow-up clinic reports, "A month ago had a severe hemorrhage and was given a blood transfusion. Much improved, feels better, and has no bleeding since. Examiation shows considerable slough still to come away, and indurated areas felt in vaginal vault posteriorly, healing. To report in a month with the possibility of having further radiation."

CASE 3.—E. F., age forty-five years, married twenty-four years; 3 children. On May 14, 1918, a supravaginal hysterectomy was performed at the Woman's Hospital for a large multiple fibroid extending to the umbilicus. A bilateral salpingo-oophorectomy, appendectomy and perineorrhaphy were performed also. The mucous membrane of the cervix was coned out according to the standard technic of the surgeon.

Pathologic Report.—Myoma uteri and bilateral oophoritis. Provisional diagnosis had been laceration of the cervix and multiple fibroids of the uterus. She had had a discharge up to the time of admission. Follow-up note on June 7, 1922, stated patient had profuse bleeding for two weeks.

Examination showed carcinoma of the cervix apparently not yet involving the vaginal vault. Referred to the hospital for radiation. History on admission shows slight bleeding for a year and slight discharge. Radium inserted and patient discharged relieved of symptoms, condition good, cervix contracted, no bleeding; prognosis doubtful. Last follow-up clinic, February 24, 1923, reports no discharge, well with no complaints. Examination shows perfect result, cervix entirely healed, no slough, no infiltration.

CASE 4.—B. B., age forty-two years, married twenty-one years. No children. Admitted September 26, 1921, A supravaginal hysterectomy for "tumor of the womb," and bilateral salpingectomy had been performed four years previously. Data not obtained. For past two years the patient had had steadily increasing vaginal discharge, with occasional spotting, and for one year, pelvic distress, and pain in the sacral region with sharp exacerbations; also dysuria and nocturia for two months. On examination, the cervix was found to be extensively involved by carcinoma which extended in all directions into the broad ligaments. Insertion of 101.2 mg. radium for twenty-four hours.

Pathologic Report.—Adenocarcinoma of the cervix. She was discharged, relieved of symptoms, with physical condition the same.

Readmitted on December 19, 1921 with neither bleeding nor vaginal discharge but pain in the lower abdomen for eight weeks and some frequency of urination. Examination showed normal appearance of the mucosa, no slough, no induration posterior to the cervix, but involvement of the bladder base. Operative findings, vagina contracted, and carcinomatous involvement apparent high up in the cervix. Twenty-six and twenty-four hundredths mg. radium inserted for twenty-four hours at the base of the bladder and tube of 50.44 mg. radium for the same time in the cervical canal. Discharged, condition the same. Report from the Social Service Department on February 25, 1922, reported severe hemorrhage three weeks previously that necessitated packing and hemostatics, also foul discharge and temperature.

CASE 5.—B. J., aged forty-one, married nineteen years, 1 child, was admitted January 5, 1920. In March, 1917, a supravaginal hysterectomy had been performed elsewhere. Records not obtained. Since the operation, patient noticed spotting of blood at irregular and indefinite intervals, with bleeding freely at times.

Thick yellow vaginal discharge past five months with pain in both sides of the pelvis.

On examination the cervix was found hard, eroded, friable, bleeding readily and crater type. The pathologic diagnosis was carcinoma of cervix. Insertion of radium 101.6 mg. for twenty-four hours. She was discharged with general condition satisfactory. Readmitted May 27, 1920. Since radium insertion in January, 1920, there has been some vaginal discharge and bleeding, pain increased and marked urgency and frequency during past two months.

Examination showed very extensive involvement of the left vaginal wall, cervix a crater, large amount of sloughing material, bladder protruding into the crater, and rectum three-fourth filled on left side by indurated mass. No radium insertion on account of the extensive involvement of tissue. Discharged, condition the same. Report from the Social Service Department, June 13, 1921, patient dead.

Case 6.—R. A., aged forty-five years, married twenty-eight years, 3 children, was admitted on March 12, 1921. On August 6, 1920, supravaginal hysterectomy was performed for fibroid uterus, complete data not available. Four months after operation, the patient experienced great pain in the lower abdomen and shooting pain down the legs, also hemorrhage which has continued since.

Examination showed malignant degeneration of the cervical stump which was movable, and bled easily on touch. The pathologic diagnosis was carcinoma of cervix. Radium insertion 100 mg. for twelve hours. Discharged, appearance of cervix improved. Readmitted October 8, 1921, carcinoma of the cervix and surrounding structures, broad ligaments and rectum. No treatment. Discharged with no relief of symptoms. Admitted for the third time on February 22, 1922, with vesicovaginal fistula resulting from radium burn. The radium had burned out the cervix and in the upper end of the vagina was a blind pouch with the tissue inflamed. Fistula closed by Sims' method. Discharged, condition very good, symptoms about the same.

Case 7.—M. B., aged forty-eight, married, one child, was admitted July 13, 1922. In November, 1921, a supravaginal hysterectomy for fibroids and right salpingo-oophorectomy was performed. She has had constant bleeding and watery discharge since the operation. Examination showed a crater filled with granulations, the whole cervix being undermined, the canal much dilated, soft and granular.

Pathologic Report.—Adenocarcinoma uteri.

Insertion radium, 50.68 mg. twenty-four hours. Discharged in same condition.

The seven cases are compared in every aspect in Table V, and need little further comment. Although carcinoma was found clinically before three years in three of the cases, nevertheless, the symptoms presented themselves before that time in four of the cases. Two were bleeding after the operation, of which one had a discharge after the operation, and one developed a discharge in two and one-half years. Of the other two, one began to bleed in four months with discharge, and the other had a white watery discharge after the operation with no complaint of bleeding. This last case is interesting for she had an erosion of the cervix and a profuse discharge at the time of the operation, the latter continuing up to the time of admission with carcinoma of the cervix, eleven months later.

We may safely assume that carcinoma was not a new development,

but was coexistent at the time of the operation, though the pathologist reported, "No indication of malignancy," from examination of the uterus. With a profuse discharge, an erosion, and a "nodule" present, a Sturmdorf operation, at least, should have been performed. Very likely, in the course of the routine examination, the carcinoma would have been found, as in the case previously described. It is interesting to note that carbolization had no effect even temporarily on the discharge. This case illustrates how essential a very important examination of the cervix is, even though a careful pathologic examination of the uterus is made. In all suspicious cases, where circumstances do not warrant removal of the uterus, a piece should be excised for pathologic diagnosis.

In the case where the diagnosis was not made until four years after, and no symptoms appeared for two years, it is most likely that the malignancy was not present at the time that the supravaginal hysterectomy was done. There may be a question of doubt where carcinoma of the cervix was diagnosed three years after, with no discharge until two and one-half years had elapsed. The history of spotting, however, with occasional free bleeding since the operation is strongly suggestive. Therefore, we may with almost certainty, say that in three of the cases carcinoma was coexisting at the time; in one case we feel reasonably confident that it was also present at the time of the original operation, and in three of the cases the disease was most likely not present at the time of the first operation but was a new development.

In a series, therefore, of 263 cases of cancer of the cervix, the above 7 had a previous supravaginal hysterectomy, or 2.66 per cent, regardless of the time incidence. The number of cases which developed really subsequently being only 3 in 263, the true percentage of incidence is much lower, only 1.14 per cent.

There was definite clinical evidence of a pathologic condition of the cervix in one case, with discharge, and the same was very likely true of two other cases, in which there was a discharge immediately after and within four months. To leave a cervix, therefore, that is definitely pathologic, causing various symptoms of pelvic discomfort, discharge bleeding, and infection, with the strong possibility of future malignancy, seems nothing short of very great negligence on the part of the surgeon. If the entire cervix, or the diseased area cannot be removed with the body of the uterus, it should be done as soon as possible.

That one cannot place entire reliance on the laboratory is illustrated by Cases 1 and 2. In the first case, although the pathologic diagnosis was made of polypoid hyperplastic cervical mucosa, the patient, nevertheless, died not long after of extensive carcinomatous

TABLE V

SEVEN CASES OF CARCINOMA OF CERVIX AFTER SUPRAVAGINAL HYSTERECTOMY

CASE	AGE	OPERATION FOR	TECHNIC CERVIX	OCCUR. BLEED. AFTER OPERATION	OCCUR. DISCHARGE AFTER OPERATION	PLACE OF OPERATION	TIME ADMIS. CAN. CERVIX AFTER OPERATION	COND. CERV. AT OPERATION	RELATION TO PREGNAN.	PATH. REPORT UTERUS	PATH. REPORT CERVIX	RESULT TREAT.
1	60	Pelvic inflammation	Carbolized	11 years	11 years	Woman's Hospital	11 years	Infection of cervix	No children	Uterus 8-4-3 Mucosa shows few glands	Scant am't. mucous mem. Polypoid hyperplastic cerv. mucosa	Died soon after extensive carcinomatous invol.
2	36	Myoma	Carbolized	No complaint by patient	Since operation	Woman's Hospital	11 months	Erosion with profuse brownish discharge	No children	Fibr. nodules to 6½ cm. one a hemorrhagic necrotic cav. and inflam. No indic. of malignancy.	Epidermoid carcinoma cervix alveolar form	Fairly improved after 2 radiat.
3	45	Myoma	Coned out	3 years	3 years	Woman's Hospital	4 years	Laceration of cervix and discharge	3 children	Myoma uteri Bilateral oophoritis	Carcinoma of cervix	Perfect result after first radiation.

TABLE V CONT'D

SEVEN CASES OF CARCINOMA OF CERVIX AFTER SUPRAVAGINAL HYSTERECTOMY

CASE	AGE	OPERATION FOR	TECHNIC CERVIX	OCCUR. BLEED. AFTER OPERATION	OCCUR. DISCHARGE AFTER OPERATION	PLACE OF OPERATION	TIME ADMIS. CAN. CERVIX AFTER OPERATION	COND. CERVIX AT OPERATION	RELATION TO PREGNAN.	PATH. REPORT UTERUS	PATH. REPORT CERVIX	RESULT TREAT.
4	42	Myoma	?	2 years	2 years	Elsewhere	4 years	?	No children	?	Adenocarcinoma of cervix	Poor result after 2 radiation.
5	41	Myoma	?	Since operation	2½ years	Elsewhere	3 years	?	1 child	?	Carcinoma of cervix	Died after 2 radiation.
6	45	Myoma	?	4 months	4 months	Elsewhere	7 months	?	3 Children	?	Carcinoma of cervix	Not much improved after 2 radiation and repair fistula
7	48	Myoma	?	Since operation	Since operation	Elsewhere	8 months	?	1 child	?	Adenocarcinoma uteri.	Not improved after 1 radiation.

involvement of the cervix and parametrium. Not enough importance can be placed on proper clinical examination, and the necessity of excising a sufficient amount from the proper area for the laboratory. In the second case, there was no evidence of malignancy by pathologic examination of the uterus; yet the patient was admitted with cancer of the cervix in eleven months. Of course the malignancy might have been confined to the cervix, but as has already been said, proper examination of the cervix might have disclosed it.

Although six of the seven uteri removed were for myoma, giving the impression that myoma predisposes and is coexistent with carcinoma, we must remember that most of the supravaginal hysterectomies are for the purpose of removing myomatous uteri, a fact which most of the investigators seemed to have overlooked. However, the diagnosis of carcinoma of the cervix after the removal of a uterus containing hemorrhagic, necrotic, and inflammatory fibroids is very strongly suggestive of the predisposition of fibroids to carcinoma of the cervix, even though the body of the uterus showed no evidence of malignancy. This bears out the belief of many of the observers after the experience of many such cases that myomatous degeneration leads to cancer.

The stage of the disease at which radium is inserted seems to have a very important bearing on the ultimate prognosis, and the value of a thorough follow-up system such as is in vogue at the Woman's Hospital to make possible an early diagnosis, is well demonstrated in Case 3. After profuse bleeding for two weeks, diagnosis was made of carcinoma of the cervix in the follow-up clinic; the patient was referred to the hospital for radiation, which produced a perfect result, and cleared the patient of her symptoms. This is one of many cases, at this hospital, which have shown the unquestionably good results of radium applied in early cases of carcinoma of the cervix, as proved by the follow-up clinics. Case 1, although having a similar very short history, with treatment immediately after, apparently was already extensively involved. This case, besides, had already passed the five year period after which the patient is no longer under such careful observation. Case 2, also operated at the Woman's Hospital, was followed closely and as soon as the inflamed eroded cervix was noted in the follow-up clinic, pathologic examination found carcinoma. Radium was inserted and after some time with a second radiation, the patient was in fairly good condition. The other four cases, had had their symptoms for a much longer period of time before the diagnosis was made, showing the necessity of adequate follow-up clinics. The poor results obtained in these four cases, operated at other hospitals, may in a great measure be attributed to the delay in diagnosis and the application of radium.

Finally, the merits of the various technics employed in regard to the cervix, may be discussed. It is evident that neither coning out nor carbolizing of the cervical stump prevents future cancer. However, coning out of the cervix does help prevent infection as seen in Case 3, in which there was no discharge for three years, though the cervix was lacerated. A discharge in Case 2, was apparently unaffected by carbolization, even temporarily. Moreover, of 377 supravaginal hysterectomies with coning out of the cervix, only 0.26 per cent developed carcinoma of the cervix, while of 595 supravaginal hysterectomies with carbolization of the cervix, 0.33 per cent developed future malignancy. The advocates of carbolizing the cervix claim it prevents future infection, but since it fails in this, and, of course, cannot be a cancer preventing measure according to its most optimistic adherent, it should be discarded in favor of the technic of coning out the cervix. This technic, taking the same amount of time, is not only a better safeguard against future infection, but also in a great measure prevents the future occurrence of carcinoma, by removing the greater part of the original focus.

CONCLUSIONS

1. In a series of 1,114 supravaginal hysterectomies at Woman's Hospital, 3 or 0.27 per cent developed subsequent carcinoma of the stump.

2. In a series of 263 cases of carcinoma of the cervix, 7 or 2.66 per cent had had a supravaginal hysterectomy for a nonmalignant condition, at which time, 4 of the 7 cases were most likely coexistent, leaving only 1.14 per cent truly subsequent cases of carcinoma.

3. In 377 of the operations with coning out of the cervix, 1 or 0.26 per cent developed carcinoma of the cervical stump.

4. In 595 of the operations with carbolization of the stump, 2 or 0.33 per cent, developed future malignancy.

5. Coning out of the cervix helps prevent future infection, and in a great measure, future carcinoma of the cervical stump. This technic takes no more time than carbolization, which does not even prevent infection, much less cancer, and should be adopted as a routine in supravaginal hysterectomy.

6. The occurrence of carcinoma in the stump of the cervix does not warrant a panhysterectomy with its much greater mortality. In the above series, 1,111 cervices would have needlessly been removed with the loss of the keystone of the arch and complications resulting from a disturbance of the pelvic anatomy. Moreover, even panhysterectomy does not give assurance of freedom from future malignancy.

7. Where a definite pathologic cervix which is lacerated or infected—especially where discharge is present, exists at the time of

the supravaginal hysterectomy, it should be removed then or as soon as possible.

8. All cases after a supravaginal hysterectomy should have an adequate follow-up system with definite periodic examinations for any changes in the cervix and for any history of bleeding or discharge. This is extremely important for the early detection of carcinoma, with favorable prognosis by early treatment, especially radiation.

9. A very careful examination should be made of the cervix at the time of operation (hysterectomy) to decide whether the cervix should be removed with the uterus, and if not, in all doubtful cases, a suufficient amount should be excised for pathologic examination. This is especially important where any degeneration or necrosis exists in the uterus.

10. There is a definite relationship between myoma and carcinoma of the uterus.

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A STUDY OF THE EFFECT OF ETHER ANESTHESIA ON THE ISOAGGLUTININS OF HUMAN BLOOD

By Philip Reichert and Morris Beake
(Fourth Year Students, Cornell University Medical College)

MODERN interest in transfusion may be dated from 1906 when Crile[1] reported an experimental series of 74 animal and six remarkable successes in human patients where the transfusion was a measure of last resort. Occasional severe and even fatal reactions were imperfectly understood until Jansky and later Moss[2] described four groups of isoagglutinins in human blood and methods for the testing and classification of donors and patients so that accidents might be avoided.

The average distribution as given by Moss, and later by Karsner[3] who includes the results of over five thousand tests, is about as follows:

Group 1 (universal recipient)	7%
Group 2	40%
Group 3	10%
Group 4 (universal donor)	43%

Moss found that the isoagglutinins in the serum were not affected by heating at 55 degrees C. for thirty minutes. He found also that there were no constant differences in the agglutinating abilities of sera in health and disease. Isohemolysins present in the sera were found to vary with heating and with other conditions both in vivo and in vitro, but the agglutinins resisted all conditions and remained unchanged.

Immunologists have not been willing to deny the possibility of the existence of as yet rare and unrecognized groups; indeed, recent work at Johns Hopkins by Guthrie and Huck[4] suggests the presence of a fifth and a sixth group. However, that a given serum might under certain conditions change its specific isoagglutinin has been deemed unlikely; but it has surely never been demonstrated.

Clinically it is important that the serum of the recipient should not agglutinate the cells of the donor's blood. The reverse is not important, for it seems that the dilution of the donor's blood as it enters the recipient's body is enough to nullify the effect of the agglutinin contained in the donor's serum.

Blood groups are determined in the Woman's Hospital by mixing in a hanging drop the citrate-washed blood cells with high titer known sera, and the agglutination reaction is observed by micro-

scope after a half hour at room temperature. Direct combination of the patient's serum and the donor's corpuscles is done in addition in a similar manner. The procedure has given clinically satisfactory results in a great many cases.

In September, 1922, Levine and Segall[5] reported three cases of prolonged ether anesthesia (two to two and a half hours) in which the patient's serum collected in the twenty-four hours immediately following the operation coagulated the cells of donors who had been matched before the operation and whose cells they did not then coagulate. This report was disquieting not only from a clinical standpoint, but it needed immediate confirmation or rebuttal from the laboratory, for it seemed to disprove all the universally credited notions of the immutability of the agglutinin groups.

We determined, therefore, to group in the usual way a consecutive series of fifty patients in the Woman's Hospital immediately before and immediately following a major operation. Of these we report thirty-eight cases since we eventually selected as worthy of note only those in which the time of anesthesia was more than an hour. In each case there are noted the operations performed and the comparative blood pressures as an index of the effect of the procedure on the general system. The preoperative blood samples were taken in the twenty-four hour period immediately preceding the operation; the postoperative sample was taken in no case more than five hours after the procedure—in the vast majority of the cases not more than twenty minutes had elapsed since the operation and the patient was still in profound narcosis as the sample of blood was taken.

While this work was being completed there appeared a report by Huck and Peyton of Johns Hopkins[6] stating that an exhaustive series of tests had been made on 25 operative cases before and after ether anesthesia, and had in no instance shown the serious changes described by Levine and Segall. At the end of our series we find ourselves confirming the Johns Hopkins investigators.

Our observations follow:

CASE NO.	HOSPITAL NO.	PRE-OP. TYPE	OPERATION	TIME OF ANES-THESIA	ADM. B. P.	PRE-OP. B. P.	POST-OP. B. P.	POST-OP. TYPE
1	30640	iv	Panhysterectomy appendec. bilateral salphingo-oophorectomy	1:45	116/76	132/95	132/90	iv
2	32033	ii	Umbilical herniotomy; appendect.	2:00	166/96	180/112	98/70	ii
3	32018	iv	Trachelorrhaphy; right salpingect.; appendectomy; Coffey susp.	1:30	120/86	122/85	115/80	iv
4	32091	iv	Exploratory—posterior gastroenterost.	1:40	140/82	174/110	105/80	iv
5	32096	ii	D. & C.; amp. cervix, perineorrhaphy, salpingectomy, Gilliam	1:38	118/75	130/85	124/80	ii
6	32100	iv	Amp. cervix; cystopexy; perineorrhaphy	1:35	106/58	135/80	134/75	iv
7	32105	iv	D. & C.; amp. cervix; hernia; append.; bilateral salpingect.; Gilliam	1:45		110/60	100/50	iv
8	32175	iv	D. & C.; amp. cervix; cystopexy; perineorrhapy	1:40	160/94	174/108	116/85	iv
9	32080	iv	Cystopexy; rectopexy; perineorrhapy	1:30	190/140	132/90	128/85	iv
10	32052	ii	D. & C.; amp. cerv.; append.; Gilliam	1:25	120/80	120/80	105/70	ii
11	32088	ii	D. & C.; amp. cervix; bilateral salpingo-oophorectomy; append.; suspension	1:40	158/90	176/102	122/90	ii
12	32008	ii	Ovarian cysts, adhesions, appendect. shortening of ligaments	1:34	120/70	150/80	142/80	ii

CASE NO.	HOSPITAL NO.	PRE-OP. TYPE	OPERATION	TIME OF ANES-THESIA	ADM. B. P.	PRE-OP. B. P.	POST-OP. B. P.	POST-OP. TYPE
13	31941	iii	D. & C.; cystopexy; perineorrhaphy	1:35	170/84	174/100	105/85	iii
14	31995	iv	Panhysterectomy, bilat. salpingectomy; right oophor.; appendectomy	1:50	148/64	120/80	105/80	iv
15	32112	iv	D. & C.; stem pessary; Simpson; tubal cyst	1:20	124/84	126/88	116/96	iv
16	32057	iv	Supravaginal hysterec.; appendect.	1:33	92/70	120/85	108/75	iv
17	32107	iii	Amp. cerv.; myomectomy; adhesions	1:40	142/84	144/98	94/72	iii
18	32139	iv	Amp. cerv.; Kelly on urethra; rectopexy	1:15	112/72	132/96	104/85	iv
19	32111	ii	D. & C.; perineorrh.; append.; Simpson	1:50	100/60	140/80	135/80	ii
20	32133	iv	Amp. cervix; adhesions; left salp. oophorec.; append.; Simpson	2:05	140/90	130/85	98/60	iv
21	32129	ii	D. & C.; Stürmdorff; Kelly on urethra	1:32	120/80	170/110		ii
22	32156	iv	D. & C.; append.; adhesions; Simpson	1:20	184/120	222/130	134/96	iv
23	31002	ii	Bissel's cystocele operation	1:15	150/80	188/110	110/90	ii
24	32177	iii	Radical amputation of breast	2:00	146/86	165/110	110/75	iii
25	32166	iv	Panhysterectomy and append.	1:13		150/110	115/65	iv

CASE NO.	HOSPITAL NO.	PRE-OP TYPE	OPERATION	TIME OF ANES-THESIA	ADM. B. P.	PRE-OP. B. P.	POST-OP. B. P.	POST-OP. TYPE
26	29333	ii	D. & C.; Bissel retroversion; appendect.	1:33	126 80	142 96	114 74	ii
27	32201	iv	Mayo; rectopexy; perineorrhaphy; gum-glucose during operation	1:44	144 80	152 98	130 70	iv
28	32180	iv	Myomectomy; appendectomy (hemorrhage and shock)	1:10	118 80	125 96	98 74	iv
29	32197	iii	Supravag. hysterect.; bilat. salpingect.; left oophorect.; appendect.	1:30	110 78	120 85	110 65	iii
30	32187	iv	Supravaginal hysterectomy	1:00	116 76	126 82	140 90	iv
31	29146	iv	Enterocele; hemorrhoidectomy	2:15	130 80	140 80	125 90	iv
32	32189	ii	D. & C.; adhesions; append.; Simpson	1:30	118 80	140 95	142 96	ii
33	32172	iv	D. & C.; amp. cervix; rectopexy	1:05	134 90	150 90	120 70	iv
34	32208	i	Bilat. salpingect.; app.; ventral susp.	1:00	124 80	110 70	118 70	i
35	32161	ii	Amp. cervix; perineorrhaphy; appendect.; Simpson	1:50	108 70	115 90	115 90	ii
36	32200	ii	Resection right tube; appendect.; Bissel retroversion	1:40	102 72	128 98	124 94	ii
37	32221	iv	Supravaginal hysterectomy	1:30	126 78	128 94	124 92	iv
38	32216	iii	Myomectomy	1:30	110 76	125 80	105 70	iii

CONCLUSIONS

1. Prolonged ether anesthesia was not found to cause any change in the isoagglutinative phenomena of the human blood.

2. We find no evidence for believing that when patients are transfused within the twenty-four hour period following a profound ether anesthesia from donors previously matched and found suitable, any severe reaction that may chance to occur can be traced to changes in the isoagglutinative phenomena of the recipient's blood.

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POSTTRANSFUSION REACTIONS: A REVIEW OF 190 TRANSFUSIONS PERFORMED AT THE WOMAN'S HOSPITAL, NEW YORK CITY

By M. C. Souter and Garrett D. Duryea, A.B., M.D.
(Fourth Year Students, Cornell University Medical College)

IT is to the energy, skill, and genius of such men as Crile, Landsteiner, Jansky, Moss and countless others that today we owe the comparative ease and safety of blood transfusion as a therapeutic measure. Accurate and rapid methods of typing have been developed and the technic of transfusion has been greatly simplified and perfected, and yet posttransfusion reactions occur with alarming frequency. The real cause of these reactions is as yet unexplained. It is the purpose of this review to discover the causative factors in posttransfusion reactions and to determine the effect, if any, of the reactions on the results of the transfusion.

We have reviewed 190 transfusions performed on 167 patients from July 1, 1922, to April 1, 1924. This is the total number of transfusions done at the Woman's Hospital during that period, with the exception of 12 transfusions given to obstetrical patients, which were not considered in this series. Of the 167 cases 161 were operated upon.

BLOOD GROUPING

The Moss classification is used as the standard and the grouping of all patients is done by laboratory technicians who use the Moss hanging drop method. The test is easily performed; the apparatus is quickly set up; and the presence or absence of agglutination is observed under the microscope. Half an hour is allowed to elapse after the preparation of the drop before concluding that there is no agglutination. Furthermore, in all the cases except three, the donor's and recipient's blood were matched directly. A hanging drop preparation is made with the recipient's serum and the donor's cells in a 1:20 dilution with 3 per cent sodium citrate solution. This is examined after half an hour for evidences of agglutination. In the three emergency cases which were not directly matched severe reactions followed. It was found that the reactions had been due to misgrouping. This shows that unless a reliable laboratory is at hand to carry out accurate grouping the direct testing of donor's and recipient's blood is the only way to be sure of their compatibility.

TRANSFUSION TECHNIC

The method of transfusion used in all cases is the syringe cannula method of Unger for the transfusing of whole unmodified blood.

INDICATIONS FOR TRANSFUSION

In this paper no attempt has been made to discuss the indications for transfusion. This has been well done in an excellent article by Ottenberg and Libman. In the last fifty years the indications for transfusion have changed very little. The field of usefulness of the operation has been widened by the invention of safer methods for its performance but very few new indications for its use have been added. Blood transfusion is used as a prophylactic treatment at the Woman's Hospital rather than as a therapeutic measure of last resort. The majority of cases in this series were suffering from surgical conditions of a purely gynecologic nature. It is thought that patients in a debilitated condition should receive the benefit of transfusion before undergoing serious operations. With such patients the shock is less and recovery quicker. Transfusion is also used in cases of postoperative hemorrhage and shock.

REACTIONS

Blood transfusion has features which are embarrassing to the physician and uncomfortable and dangerous to the patient. For this reason some will be deterred from using the measure on a patient in a critical state in fear of doing harm by the procedure itself. For a therapeutic measure to gain wide favor it must be free from any dangers incident to the procedure itself, or at least a wide margin must exist between risk and gain. It was felt that increasing familiarity with the technic would eliminate the dangers but this hope has proved vain. Reactions persist despite the most painstaking efforts to discover their cause and origin. Furthermore, we cannot foretell when a reaction will or will not occur.

The problem of posttransfusion reaction has been successfully dealt with only in its gross aspects. Due to the experimental work of Jansky, Moss, Lewisohn, and Unger in modifying the technic of the operation and perfecting the method of grouping patients the dangers of gross incompatibilities, pulmonary edema, and the introduction of air into the circulatory system have been eliminated. The danger of a severe reaction can be escaped, but the factors which cause the milder, unpleasant reactions must be found and prevented.

CAUSES OF REACTIONS

Lindeman is emphatic in his assertion that all febrile reactions in his cases are due to hemolysis. He cannot prove this because in many cases this hemolysis is so slight that it cannot be detected by ordinary laboratory methods. He claims that posttransfusion reactions are comparable to the chills and fever of malaria. Hemolysis sets hemoglobin free in the circulating blood and it is this free hemo-

globin which causes the chills and fever. In every case of clinical hemolysis some error was found in the laboratory technic of blood grouping. Therefore, Lindeman concludes that by carrying out careful and complete hemolysis and agglutination tests reactions can be avoided. But it is apparently inevitable with the best testing to prevent rare instances of extensive hemolysis as shown by cases reported by Drinker, McClure, and Dunn, and Sydenstricker.

Some posttransfusion reactions resemble anaphylactic shock but since the real nature of this phenomenon is as yet an unsettled question this does not tell us much. The fact that many patients are relieved by adrenalin and epinephrin bears out this theory.

Drinker and Brittingham contend that reactions are due to changes in the blood incident to coagulation, resulting in the formation of abnormal proteins. In no method of transfusion except vessel to vessel suturing is there a possibility of preventing the formation of these toxic products. Even when the blood is grossly fluid it may have progressed to the first stages of coagulation. Toxicity resides in the formed elements of the blood, especially the platelets which become abnormal immediately upon leaving the vessel. The grade of abnormality depends upon their handling. On this phase of reaction causation will depend the fact noted by others that dexterity in any method of transfusion means fewer reactions. This fact will be referred to again. The similarity between posttransfusion reactions and those following injections of typhoid vaccine suggests that individual variations in the recipients, as well as the varying ability of different coagulating blood to produce foreign proteins, are factors in producing reactions.

The question is raised by some whether the milder reactions are due to the same cause as the severe ones which follow gross incompatibility. Meleney, Drinker, and others consider that all posttransfusion reactions should be in one category—and that the field of immunology.

It is in this field that the latest experimental work has been done. Very recently Guthrie and Huck working at Johns Hopkins Hospital have carried on a detailed study of the isoagglutinins and isohemolysins in the blood. They have revolutionized the classifications of Jansky and Moss and have produced evidence that there are more than four isoagglutination groups in human blood. In their first paper they stated that there are at least three isoagglutinins and isoagglutinogens. Since then they have demonstrated two additional isoagglutinins.

These findings have a bearing of practical importance upon posttransfusion reactions. If a patient is transfused with the blood of a donor apparently of the same group but whose cells contain an additional agglutinogen which is not detected by ordinary matching

and is not present in the cells of the recipient, the recipient may become immunized to the foreign agglutinogen and develop corresponding agglutinins in his own blood which would cause a reaction after a second transfusion. This fact would be apparent if the blood were retyped after the first transfusion.

Other investigators have explained posttransfusion reactions as due to the change in protein plasma by its contact with glassware, rubber tubing, and metal. But the lack of uniformity in the occurrence of reactions when the same apparatus is used would disprove this theory. Definite conclusions as to the causes of reactions cannot be drawn until the field has been more fully investigated experimentally.

STATISTICS

Before approaching the data which we have obtained from the study of our cases it is worth while to sum up the most recent reaction statistics. In the literature wide variations occur in the number of posttransfusion reactions which different workers report. This is due in great part to the difference in interpretation of the term reaction.

Lewisohn reports that chills occurred in 10 per cent of his 75 cases. Meleney reports 64.6 per cent reaction, i.e., chill with a sharp rise in temperature. Sydenstricker reports reactions in 17 per cent of 100 cases which he reviewed. Lindeman found a rise in temperature of more than two degrees in 33 per cent of 150 cases. Drinker and Brittingham had an average of 32 per cent of reactions in 83 transfusions. Using the direct method of whole blood transfusion Sloane and Bernheim each had 5 per cent of reactions. Unger reports in a series of 85 transfusions 8 cases as having febrile reactions. Brem reports in 191 cases 25 per cent reactions.

Reactions are of various types and degrees. The typical reaction as described by Meleney consists of a chill coming on about one-half hour after the transfusion, a sharp rise in temperature, gradually subsiding to normal in three to eight hours, sometimes associated with nausea, vomiting, pain in the joints, dyspnea, urticaria, and headache.

Most of the transfusions in our series have been performed on patients at the time of operation so the presence of a low grade temperature cannot be taken as evidence of a posttransfusion reaction unless there are also present some of the symptoms mentioned above. Taking as a criterion of reaction subjective symptoms with or without a rise in temperature of at least 2.5 degrees we have found that of the 190 transfusions performed, 49 cases or 25.7 per cent were followed by reactions.

The frequency in appearance of the various manifestations of reaction was represented as in Table I.

TABLE I

MANIFESTATIONS OF REACTION	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS
Chill	40	81.6
Temperature rise of at least 2.5 degrees	27	55.1
Edema	3	6.1
Nausea or vomiting	5	10.2
Urticaria	5	10.2
Headache	4	8.1
Respiratory distress	2	4.0
Pain in joints	2	4.0
Diarrhea	1	2.0
Unconsciousness	1	2.0

Chill and rise in temperature of at least 2.5 degrees are the most frequent symptoms of reaction.

The time elapsing before the appearance of symptoms varies widely as shown in Table II which represents 43 cases in which the time was recorded.

TABLE II

TIME	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS
Immediately	8	18.6
Less than 4 hours	23	53.4
4 to 12 hours	2	4.6
12 to 24 hours	2	4.6
24 to 36 hours	8	18.6

Table II indicates that the majority of reactions occurred in less than 4 hours from the time of transfusion.

Chills were present in 40 cases. There was a great variation in degree of severity, from a chilly sensation lasting a very few minutes to a severe chill lasting one hour. Tables III and IV indicate the type and the duration of chills.

TABLE III

TYPE OF CHILL	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS
Chilly sensation	3	7.5
Moderate	32	80.0
Severe	5	12.5

TABLE IV

DURATION OF CHILL	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS
1 to 5 minutes	8	21.6
5 to 15 minutes	12	32.4
15 to 30 minutes	7	18.9
30 to 60 minutes	10	27.0
Not recorded	3	

It is evident that the greater number of chills were moderate and lasted from 5 to 15 minutes.

In 27 of the cases there was a rise of temperature of at least 2.5 degrees, the average rise being 3.7 degrees. The duration of the temperature varied widely, the greatest number lasting for less than four hours as shown in Table V.

TABLE V

DURATION OF TEMPERATURE	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS
Less than 4 hours	9	33.3
4 hours to 8 hours	7	25.9
8 hours to 12 hours	2	7.4
12 hours to 24 hours	6	22.2
24 hours to 36 hours	1	3.7
36 hours to 72 hours	2	7.4

As has been stated, of the 190 cases transfused 49 cases or 25.7 per cent had reactions. Therefore, these figures are used as the basis for determining the factors which may cause reactions. The factors to be considered are:

I. *Blood Relationship.*—The relative frequency of reactions in cases where donor and recipient were or were not blood relatives is shown in Table VI.

TABLE VI

BLOOD RELATIONSHIP	NUMBER OF TRANSFUSIONS	NUMBER OF REACTIONS	PERCENTAGE OF REACTIONS
Yes	68	15	22.0
No	102	32	31.3
Not recorded	20	2	....

II. *Blood Groups.*—Table VII shows a comparison between the percentage of reactions when a universal or group IV donor was used and when the recipient and donor were in the same group.

TABLE VII

GROUPING	NUMBER OF TRANSFUSIONS	NUMBER OF REACTIONS	PERCENTAGE OF REACTIONS
Not recorded	8	..	....
Donor and recipient of same group	147	41	27.8
Universal donor	35	5	14.3
(Donor Recipient)			
(IV I)	1	0	0.0
(IV II)	22	4	18.1
(IV III)	12	1	8.3

It is evident that using a universal donor does not increase the number of reactions.

The relative number of reactions in the different blood groups of 190 cases transfused are shown in Table VIII.

TABLE VIII

BLOOD GROUP	NUMBER OF TRANSFUSIONS	NUMBER OF REACTIONS	PERCENTAGE OF REACTIONS
I	3	1	33.3
II	52	15	28.8
III	22	4	18.1
IV	105	29	27.6
Not recorded	8	..	....

There is practically no difference in the percentage of reactions in each group. If a factor of incompatibility does influence reactions it is one which is not detected by ordinary laboratory methods of grouping individuals.

III. *Operator.*—Does the causative factor of reactions lie in the skill and ability of the one who performs the transfusion? Table IX shows that there is a wide variation in the percentage of reactions in transfusions performed by different operators.

TABLE IX

OPERATOR	NUMBER OF TRANSFUSIONS	NUMBER OF REACTIONS	PERCENTAGE OF REACTIONS
A	28	4	14.2
B	28	7	25.0
C	17	1	5.8
D	14	4	28.0
E	13	4	30.0
F	1	1	100.0
G	7	2	28.5
H	9	5	55.5
I	21	5	23.8
J	24	4	16.6
K	5	3	60.0
L	11	1	9.0
M	12	8	66.0

If one accepts the theory of Drinker and Brittingham, that reactions are due to the formation of abnormal proteins as the result of destruction of the blood platelets during the operation, the skill and deftness of the operator surely would be a factor of considerable importance. It is shown in Table IX that some operators do have a higher percentage of reactions. It would be difficult to estimate the importance of this factor as a cause.

IV. *Time.*—The transfusions were either preoperative, performed during the operation, or postoperative.

Table X shows that the highest percentage of reactions occur in cases which were transfused before operations. This is probably due to the fact that the patient is at that time better able to respond to the introduction of a foreign substance.

TABLE X

TIME	NUMBER OF TRANSFUSIONS	NUMBER OF REACTIONS	PERCENTAGE OF REACTIONS
Preoperative	91	34	37.3
During operation	13	0	0.0
Postoperative	53	15	28.3
Not recorded	33		

V. *Amount of Blood Given.*—The relative frequency of reactions following the transfusion of varying amounts of blood is shown in Table XI.

TABLE XI

AMOUNT	NUMBER OF TRANSFUSIONS	NUMBER OF REACTIONS	PERCENTAGE OF REACTIONS
Less than 300	10	3	30.0
300 to 500	30	7	23.3
500 to 700	135	35	25.9
700 to 900	8	1	12.5
Not recorded	7		

From Table XI it would appear that up to a certain point the larger the amount of blood transfused at one time the greater the number of reactions. It is a question whether small amounts of blood (less than 500 c.c.) given frequently would be followed by fewer reactions than are large amounts given at one time. The comparative ease of the technic makes the former possible now whereas it was not possible a few years ago. This problem falls into the scope of the discussion of the next factor, namely:

VI. *Repeated Transfusions.*—Table XII shows the increase in the number of reactions in subsequent transfusions. It may be noted here that no patient had more than one reaction.

TABLE XII

TRANSFUSIONS	NUMBER OF TRANSFUSIONS	NUMBER OF REACTIONS	PERCENTAGE OF REACTIONS
First	147	42	28.5
Second	17	6	35.2
Third	3	2	66.6
Not recorded	23	..	....

This shows that repeated transfusions do increase the tendency to reaction. Ottenberg, Kaliski, and Freedman were the first to show that where multiple transfusions were given the recipient developed specific agglutinins and hemolysins against the donor's cells. Ottenberg and Libman later reported that the likelihood of hemolysis occurring is distinctly greater in the second and third transfusions, due to the development of immune hemolysins and isoagglutinins. But they add that there is no real danger provided that the tests for hemolysis and agglutination are carefully done. Meleney reports that

the increase in the number of reactions is in direct proportion to the number of transfusions given; also that subsequent donation from one person to the same recipient increases the number of reactions. The recent work of Guthrie, Huck, and Pessel gives one explanation for these facts.

What effects do posttransfusion reactions have upon the general condition of the patient as indicated by her pulse and blood pressure, and upon the benefits which the patient should derive from the transfusion? Change in pulse rate is the first thing to be considered. Tables XIII and XIV are a comparison between the rise and fall of the pulse rate in the patients who had had no reactions and those who had had reactions. The time period for the rise or fall was forty-eight hours.

TABLE XIII

PATIENTS WITH NO REACTIONS

PULSE	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS	AVERAGE VARIATION IN POINTS
Rise	33	32.0	12.1
Fall	57	55.3	13.9
No change	13	12.6	....
Not recorded	87	....	....

TABLE XIV

PATIENTS WITH REACTIONS

PULSE	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS	AVERAGE VARIATION IN POINTS
Rise	24	55.8	13.5
Fall	15	34.8	12.8
No change	4	9.3	....
Not recorded	6	....	....

From Tables XIII and XIV it is evident that after transfusion the pulse rate had a tendency to fall except in cases where reactions caused a rise. The average actual rise or fall in pulse rate was practically the same both in cases with and without reactions.

There was a somewhat constant variation in blood pressure in those cases which had reactions and those which did not. In the greater percentage of cases with reactions the blood pressure was raised. In the majority of cases without reactions the blood pressure fell. This is shown in Tables XV and XVI. When the systolic pressure was raised and the diastolic fell or vice versa, that case was classified as irregular. In other cases both the systolic and diastolic pressure either fell or rose together.

As indicated in Tables XV and XVI reactions have a tendency to raise the blood pressure. In patients who have a very high blood pressure before transfusion this fact gains importance and may cause serious results.

TABLE XV

PATIENTS WITH NO REACTIONS

BLOOD PRESSURE	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS
Rise	28	32.2
Fall	33	37.9
Irregular	22	25.2
Not changed	4	4.5
Not recorded	54	....

TABLE XVI

PATIENTS WITH REACTIONS

BLOOD PRESSURE	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS
Rise	13	30.9
Fall	12	26.1
Irregular	14	33.3
Not changed	3	7.1
Not recorded	7	....

In order to illustrate the average rise and fall in points of the pulse and the systolic and diastolic pressure Graphs 1 and 2 have been made. The first represents such curves for those patients with reactions—the second for those without reactions.

It is interesting to note the results of investigation in order to discover what influence reactions have on the desired benefits of transfusion—that is, upon the hemoglobin determination and red blood cell count. The data available cover observations of these two points only during a period of forty-eight hours. The ultimate benefits to the patient after this short period were not recorded.

Table XVII shows the percentage of cases with and without reactions which had either an increase or a decrease in hemoglobin. It also shows the average percentage of increase or decrease.

TABLE XVII

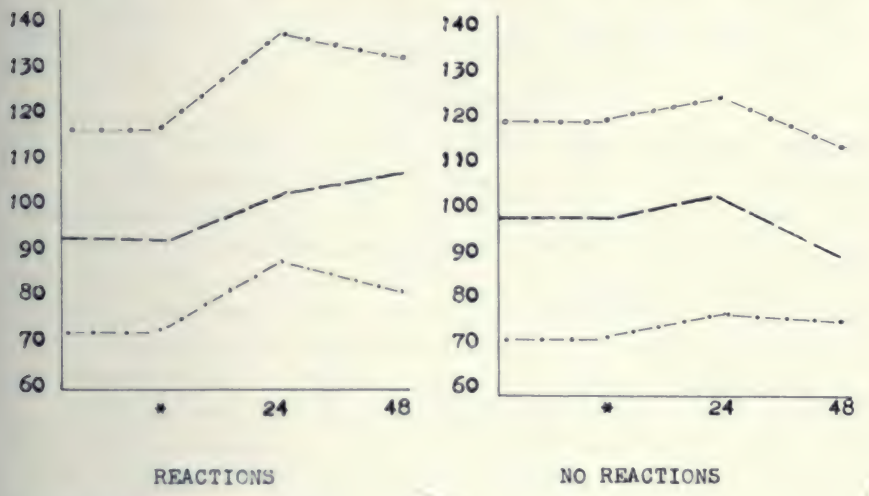
HEMOGLOBIN	NO. OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS	NO. OF CASES WITH REACTIONS	PERCENTAGE OF CASES WITH REACTIONS	NO. OF CASES WITHOUT REACTIONS	PERCENTAGE OF CASES WITHOUT REACTIONS
Rise	138	87.3	42	91.3	96	85.7
Fall	20	12.6	4	8.6	16	14.2
Not recorded	32	....	3	....	29	....

In the total number of transfusions there was an average rise of 29.8 per cent in the hemoglobin and an average fall of 16 per cent. In the cases with reactions the average rise of hemoglobin was 35.6 per cent, the average fall 13.7 per cent, while in those cases without reactions the average rise and fall were 27.2 per cent and 16.6 per cent respectively.

TABLE XVIII

RED BLOOD CELL	NO. OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS	NO. OF CASES WITH REACTIONS	PERCENTAGE OF CASES WITH REACTIONS	NO. OF CASES WITHOUT REACTIONS	PERCENTAGE OF CASES WITHOUT REACTIONS
Rise	134	84.2	42	93.3	92	80.7
Fall	25	15.7	3	6.6	22	19.2
Not recorded	31	....	4	....	27	....

Table XVIII shows a comparison in the rise and fall of the red blood cell count in cases with and without reactions. In the total number of transfusions there was an average rise of 26.1 per cent in



Graphs 1 and 2.

the red blood cell count and an average fall of 12.8 per cent. In the cases with reactions the average rise in the red blood cell count was 30.5 per cent, the average fall 13.5 per cent, while in those cases without reactions the average rise and fall were 24.1 per cent and 12.7 per cent respectively.

Tables XVII and XVIII show unexpected and interesting results. The fall in hemoglobin and red blood cells is chiefly found in cases which were transfused either during operation or following operation. It is evident from the tables that there is a higher percentage of cases with an increase in both hemoglobin and red blood cells among those patients who had reactions than among those patients who did not have reactions. Also the average percentage increase in both hemo-

globin and red blood cells is greater in patients with reactions. In reviewing the literature on this subject no report has been found showing the actual effect of reactions on the red blood cell count and hemoglobin determinations. Therefore, it cannot be stated whether these findings are unusual or not. One might naturally expect to find that reactions delayed the rise in hemoglobin and red blood cells and lessened the benefits of transfusion. From this investigation it would seem that reactions had the opposite effect. The process which brought about these results may be similar to that occurring when foreign protein injections are given. The injection of proteins, such as milk in cases of chronic infection, stirs up the natural body defenses and increases the individual's resistance. In the same way the blood forming organs may receive stimulation from posttransfusion reactions as well as from the transfused blood itself.

SUMMARY

From a careful study of 190 transfusions performed during the period from July 1, 1922, to April 1, 1924, we conclude that:

1. Direct matching of donor's and recipient's blood is a procedure which will eliminate some posttransfusion reactions even when the individuals are grouped by a reliable laboratory. The efficacy of this procedure is shown by the fact that severe reactions followed in the only three cases of our series in which this was not done.

2. Posttransfusion reactions showing subjective symptoms and with or without a rise in temperature occurred in 25.7 per cent of cases.

3. In the highest percentage of cases reactions appeared in less than four hours and were manifested most frequently by moderate chills lasting from five to fifteen minutes and an average rise in temperature of 3.7 degrees lasting less than four hours.

4. Blood relationship of donor and recipient, the use of the universal donor, and the blood group of the recipient seem to have no influence in causing reactions.

5. The percentage of reactions which the various operators have after giving transfusions varies widely. The skill and dexterity of the operator may, therefore, be of some importance as a causative factor.

6. Transfusions given before operation are followed by a higher percentage of reactions, probably due to the better response of the patient to the injection of a foreign substance.

7. Transfusions of more than 500 c.c. of blood are followed in most cases by more reactions than when smaller amounts are given.

8. Repeated transfusions increase the percentage of reactions.

9. Posttransfusion reactions have a tendency to increase the pulse rate and to raise the blood pressure also. This may be of some importance in instances of very sick patients.

10. At the end of forty-eight hours the highest percentage of increase in hemoglobin and red blood cells occurred in those patients who had had reactions. Whether this is the usual finding cannot be stated since no similar comparison has been found in literature.

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THE TREATMENT OF INCOMPLETE ABORTION

An Analysis of the Management of 311 Cases of Incomplete Abortion Treated at the Woman's Hospital, New York City from September, 1919 to January, 1924

By Joseph Herzstein and Irene Davis

(Fourth Year Students, Cornell University Medical College)

INTRODUCTION

At the suggestion of George Gray Ward, Chief Surgeon of the Woman's Hospital, New York City, the following study was made of the treatment of incomplete abortion. The series of cases studied is composed of over 300 unselected cases treated at the Woman's Hospital during the period of September, 1919, to January, 1924.

PURPOSE OF THE STUDY

The essential purpose of the study was to determine the results of different methods of managing cases of incomplete abortion. The recent literature on the treatment of abortion contains numerous discussions of the "active" versus the "conservative" handling of such cases. The general trend of opinion is definitely in favor of conservative treatment, for septic cases especially.

In view of the interest and importance of the subject, it seemed desirable to analyze the results obtained among patients treated for this condition at the Woman's Hospital. Here both types of treatment were accorded on the different divisions so that the possibility presented itself for a comparison of the indications and results of the two methods of treatment.

DIGEST OF RECENT LITERATURE

Before presenting our data, the findings of others who have dealt with this problem will be cited. It is not proposed to give an exhaustive or historical review of the very extensive literature on abortion. The present literature, especially in Germany, is replete with discussions on the treatment of abortion. Most of the writings deal with the treatment of septic abortion, the handling of which type of case has given rise to considerable controversy. It is our purpose only to refer to several of the more recent contributions on the subject, space not permitting a more lengthy review.

In this country, DeLee[1] in 1913, in discussing the treatment of incomplete abortion, says that the best treatment is removal of the retained

secundines. One method advised is immediate curettage, dilating the uterus if necessary. A second method, recommended as better for the general practitioner, is packing the uterine cavity inserting a tampon in the vagina and waiting for the contractions of the uterus to expel its contents. If the patient is in a good maternity hospital and the cervix is soft and open for the finger, the uterus can be cleared of its contents at once. In septic cases of abortion, where the uterus is full of decomposing ovular and blood masses, bleeding usually commands their removal, and this must be done as gently as possible. DeLee suggests gauze packing for twenty-four hours, which may be repeated. Pituitrin and ergot may be used. He says: "Only after the septic symptoms have subsided may the placental masses be removed by the finger or ovum forceps." The curette should be avoided.

McPherson,[2] in 1912, reported on 3,500 cases treated medically at the Lying-In Hospital, New York. For incomplete or inevitable abortion, the uterus and vagina were packed at once with iodoform gauze, after material presenting within the grasp of forceps was removed. After twenty-four hours curettage was performed. When necessary the cervix was dilated, the uterus being explored with a sponge forceps, followed by a sharp curette. No douches were used. The uterine cavity was wiped out with dry gauze, then with tincture of iodine, and an iodoform drain inserted. Radical treatment was given in 2,803 of 3,500 cases, with satisfactory results in 97 per cent of all cases so treated. The mortality for all classes of cases was 1.8 per cent.

Vineberg and Wiener,[3] in 1917, reported on the work at Mount Sinai Hospital, New York, where they handled 287 cases in a five-year period. They had 60 cases with an admission temperature of 101° to 105°. All of these cases were curetted at once. Their mortality of 3 per cent was due to one case of pulmonary embolism and one case of septic pneumonia following a perforation of the uterus. They used placental forceps and a sharp curette. For cases of from eight to ten weeks of gestation, a vaginal hysterotomy was performed. They did not use gauze packing for the uterus, but did use tincture of iodine. They adhere to the active treatment of abortion and cite others, namely Haberle, Schottmuller, Frommel, and Warnekros in Germany, who like themselves have not favored Winter's plan of expectant treatment.

McPherson,[4] writing again in 1918, expressed his radical difference in opinion from those who opposed curettage. His method then was similar to the one described earlier. He also suggested the taking of cultures from the cervix and vagina.

Hellier[5] of Leeds, England, 1919, believes in the early and complete evacuation of the uterus in cases of incomplete abortion. This is done manually and with a forceps similar to a sponge forceps. He believes

in flushing the uterus with antiseptic, using a flushing curette. He uses iodine and a twenty-four hour packing.

Hillis,[6] in 1920, made a study of abortions at the Cook County Hospital, Chicago. He arrived at the conclusion that in septic cases no operative procedure should be carried out until the patients were five days fever-free.

Among 200 cases of septic abortion, all had a temperature of 100° or more on admission. Of these, 100 had artificial emptying of the uterus, during the febrile period and as soon as convenient. In a parallel group of 100 cases, no local treatment was applied. His results definitely favored the conservative method of treatment as indicated by Table I.

TABLE I

	CURETTED CASES	CASES WITH NO LOCAL TREATMENT
Average days of fever	8.10	3.50
Average days in hospital	13.28	8.48
Complications (per cent)	19.00	4.00
Per cent mortality	3.00	1.00

In another series of 122 cases of nonseptic abortion, alternate cases were treated operatively by curettage when there was profuse bleeding or when it was very evident that placental tissue remained. The other cases were treated expectantly unless profuse hemorrhage occurred.

Of the 55 cases placed on the active list, 16.36 per cent did not have to be curetted. On the other hand, of the 67 cases assigned for expectant treatment, 29, or 40 per cent had to be. There was no striking difference between the active and expectant cases in average days of temperature, lochia rubra and stay in the hospital. There were only two complications and the mortality was nil.

Hillis concludes that the nonseptic cases should be curetted as a routine. His belief is based on the fact that (1), 40 per cent of expectantly treated cases had to be curetted; (2), it insures an empty uterus and prevents subsequent bleeding; (3), it shortens the stay in the hospital; and (4), the procedure is relatively harmless in comparison with the good it accomplishes.

King[7] (1920), of New Orleans, is also one who believes in noninterference for septic cases, unless the cultures become negative and the temperature becomes normal, except in cases with presenting placental tissue and with profuse bleeding due to retained secundines. He cites 145 incomplete abortion cases in which nonoperative methods failed to bring about complete evacuation of the uterus. The ovum forceps or finger was used in 102 cases, the dull curette in 43. Of the 43 cases, 8 had fever before and after operation. Of the 35 without fever before curettage, 3 developed a mild rise in temperature afterward.

Ashhurst,[8] (1921), believes in the immediate evacuation of the uterus in cases of incomplete abortion. In his practice if patients give a history of having aborted before admission, they are at once anesthetized. With aseptic care the cervix is dilated if necessary. Blunt placental forceps are introduced and the uterus is cautiously explored. A curette is never used for these cases. If wide enough, gauze is introduced on the finger and evacuation secured. He says, "I have come to regard it as very important to do this evacuation invariably as soon as the patients are admitted. If one waits there will be a certain proportion of the patients who will develop sapremia, or even septicemia, the latter of which condition is very nearly fatal, and even the sapremia is a complication which it is better to avoid than to relieve."

During a six-months' period he reports the recovery of 21 cases of incomplete abortion in which the uterus was evacuated on admission. Only two out of 23 cases (20 incomplete and 3 threatened) ran any temperature after evacuation. He does not mention the preoperative temperatures.

Gordon[9] presented his views in favor of conservative management of abortion, in 1921. In a series of 530 consecutive cases treated at Bellevue Hospital, he applied conservative treatment to the majority. One-sixth of the cases were septic with a rectal temperature over 101°. These were given no intrauterine manipulations. Curettage was executed in the aseptic cases only in the event of treatment by vaginal packing being unsuccessful. There were 381 who were packed once, 81 twice, 131 required no packing and only 18 were curetted. The average stay in the hospital after curettage was nine days. The average stay of the aseptic cases was seven days in the hospital; the septic ones stayed twenty days on the average. Gordon takes the position that curettage is not only seldom indicated, but that it is often actually harmful.

Williams[10] (1922), is an ardent proponent of manual evacuation of the uterus in incomplete abortion. While this can be done satisfactorily with a curette and polypus forceps, he believes the use of the finger, employing the sense of touch, is better. If the cervix is not sufficiently dilated, due to the retraction which occurs several days after the expulsion of the fetus, Williams suggests the use of a Goodell dilator to permit the introduction of the finger.

Yates and Connelly,[11] of Detroit (1922), believe that in cases of incomplete abortion, the sooner the uterus is emptied the better. They use the gloved finger in accomplishing this. With free bleeding and a closed cervix in afebrile cases they believe in packing for twenty-four hours.

Within the present year Hillis[12] (1924) has reported on the experience of 1,000 cases of abortion also treated at the Cook County Hospital in Chicago, from 1920 to 1923.

These cases were alternately assigned to an active treatment group or a conservative treatment group. Of the total 1,000 cases, 77.2 per cent were of the incomplete type. Patients with inevitable abortion assigned to the conservative group were not curetted unless bleeding threatened life or unless the bloody discharge persisted over ten days with a normal temperature. No patient with a temperature over 100° was curetted unless hemorrhage threatened life.

Cases assigned to the active treatment group and bleeding, were curetted after the temperature reached normal and stayed down for five days. In the presence of fever the use of the curette was avoided if possible.

Of the total cases, 241 were curetted, while 959 were not. Those that were curetted, however, did not have a longer febrile period.

Of the patients who were curetted, most of them (70.5 per cent) were afebrile. A little over one-quarter of the total 241 curetted cases had such alarming hemorrhage that they had to be curetted before a five-day afebrile period. In these cases, the percentage developing and continuing fever after operation was greater than in those allowed a five-day afebrile period.

Of the afebrile group which had an emergency curettage, 74 per cent remained feverless, as against 95 per cent of the group who were first allowed an afebrile period of five days. The curetted cases had an average stay in the hospital of 10.3 days; the corresponding stay for the noncuretted group was 7.79 days. The mortality was 1.24 and 2.24 per cent for the curetted and noncuretted cases respectively.

Hillis concludes that conservative treatment of abortion in febrile cases gives better results than active therapy. His experience shows that febrile patients who have a five-day afebrile period have a greater tendency to continue a normal temperature after curettage than those operated before five days. He says, "A plan of procedure which embodies a conservative rest period of five days' normal temperature for febrile and afebrile patients and results in as low a mortality as quoted in this paper, seems to be a rational method for the treatment of abortion."

The most recent American report is that of Gordon[13] (1924), who has subjected to detail study 961 cases of abortion treated at Bellevue Hospital. Most of these cases were incomplete abortions. In a consecutive group of 1,640 cases of abortion treated at Bellevue Hospital, Gordon states that 1,528 were of the incomplete variety. He believes that for this type of case, expectant treatment is indicated, unless active treatment is necessary. The latter is indicated for profuse hemorrhage over a short period of time or moderate, prolonged bleeding.

As methods of active treatment, Gordon mentions (1), vaginal pack-

ing, (2), stick-sponge removal of the products of gestation, and (3), curettage.

Of the aseptic cases, 62 per cent of the patients were packed. Pituitrin was given to those receiving the packing, which was removed in from eighteen to twenty-four hours. Frequently the products of gestation came away with the packing. Ten per cent required a second packing. If hemorrhage persists after a second packing, instrumental evacuation is said to be indicated, with placental forceps, sponge-stick, or curette. Only 3 per cent of the cases came to curettage.

For the septic cases, with a rectal temperature of over 101°, Gordon believes that intrauterine manipulation is decidedly contraindicated. In the definitely septic cases hemorrhage is moderate by the time sepsis is established, because of the time element and thrombosis. Some of these cases were treated outdoors in the Fowler position. Others had vaccines, serums, foreign protein, neutral flavine and other medication.

Of 768 aseptic cases, all recovered, with an average stay in the hospital of six days. Of 193 septic cases, 181 recovered with an average stay of twenty days. The average number of days of bleeding before the patients entered the hospital was eleven. Gordon says that "All cases of abortion, threatened, inevitable or incomplete, should be treated conservatively until it is demonstrated that conservative treatment has failed." He says that conservative treatment, properly executed, will fail in something less than four cases out of a hundred. The mortality and morbidity in abortion cases are in direct ratio with the degree of intrauterine intervention. Finally, he says curettage in abortion transposes many aseptic cases into septic cases.

RECENT GERMAN LITERATURE

We have confined the foregoing references to American writers, with but one exception, although their views, no doubt, were in part affected by the opinions expressed in other quarters. The German literature on abortion has been exceedingly abundant, and we will permit ourselves only a few representative references.

Among the earliest of persons in Germany who sponsored conservative treatment of septic cases of abortion was Winter[14] (1910), of Königsberg. His report not only stimulated bacteriologic examination before treatment of abortion cases but also stimulated a long series of reports on the subject from numerous clinics. Up to the present time clinics in Germany are reporting their results on active versus conservative treatment of septic cases.

Winter's proposals were somewhat as follows: 1. In the presence of fever, make a smear for culture, removing the remnants of the ovum from the vagina and leave alone. 2. Look for hemolytic streptococci in the bacteriologic sample. 3. If these are absent, or only occasional, or

only weakly hemolytic, even if saprophytes are present, there is no objection to emptying the uterus or to removing material in an open cervix. However, even though the analyses do not show the presence of virulent organisms, Winter does not see the indication for active dilatation or removal of all products of gestation at the first rise of temperature. He believes the injury to the surrounding tissues may permit a lighting up of virulence of staphylococci or streptococci. 4. If hemolytic streptococci are present, rigid noninterference is advised. If on account of hemorrhage the uterus must be emptied, he suggests its repeated disinfection and the manual evacuation, avoiding the curette.

Missler[15] (1920), does not confirm Winter's premise that the presence or absence of hemolytic streptococci is a guide for emptying the uterus. He found that for one case dying of infection with hemolytic organisms, there were two deaths due to nonhemolytic and two to staphylococcus infection. In the clinic at Giessen, 141 cases were treated from 1906 to 1918. The experience definitely favors conservative and expectant treatment. By expectant treatment is meant emptying the uterus after the temperature has fallen. Missler gives figures as shown in Table II.

TABLE II

METHOD	MORTALITY %	COMPLICATIONS %	DURATION OF TEMPERATURE	DURATION OF TREATMENT
Active	3.8	13.8	4.8 days	14.5 days
Expectant	0.0	5.7	3.4 "	11.9 "
Conservative	3.8	7.7	3.4 "	11.3 "

Missler says that the drop in temperature before emptying the uterus is more of an indication for intervention than the bacteriologic findings. The temperature usually drops in two and a half days. In cases treated after the temperature came down, 60 per cent had no febrile reaction. With the postponement of emptying the uterus in this way, the mortality was nil, the morbidity one-half, and the duration of treatment two and a quarter days less than under active treatment.

Neu[16] (1920), states that at the clinic in Frankfurt the results of bacteriologic studies are accepted as a guide for the method of treatment. Since this requires from two to five days, objection has been raised by those opposed to conservative treatment on the basis of the danger of bleeding during this period of waiting. Neu reviews the literature on this subject and finds that there are only two reported cases of death due to hemorrhage following abortion, and one of these cases is not confirmed (Bondy). In the Frankfurt clinic there were 3,950 cases of abortion treated from 1909 to 1920 with "no death or morbidity due to hemorrhage." He says that the bleeding can be stopped by correct vaginal tamponade which is harmless, and can be limited to about 15 per cent of the cases. The falling off in its use is suggested by him in Table III.

TABLE III

YEAR	CASES	PER CENT
1915	279	67.1
1915-16	220	74.3
1916-17	247	71.4
1917-18	184	69.4
1918-19	38	11.7
1919-20	90	16.4

Kolde,[17] of Magdeburg (1920), reviews 1,318 cases treated from 1914 to 1918. Of this number, 42.9 per cent had fever (37.5° C., 99.5° F.). In almost all the cases the uterus was emptied at once. A smooth course was followed in 72.4 per cent of the cases; these were in the hospital eight days. A group with a slower drop in temperature (fourteen days) is described as slightly sick, 16.8 per cent, while 3.7 per cent are described as very sick. Of the cases with fever, the mortality was 7.1 per cent. Of the 42 patients dying, 40 were septic on admission and not all of these received active treatment. His general mortality was 3.18 per cent. The mortality limited to those with active treatment was 3.8 per cent. He does not regard bacteriologic studies as a guide for treatment and does not see any reason for departing from active treatment. He uses blunt instruments only for curettage, and also hot salt irrigations but no packing.

Prinzung[18] (1921), reports on the work of the maternity and gynecologic divisions of the Katherinenhospital in Stuttgart. He cites a long list of opponents and proponents of conservative handling of abortion. He himself favors conservatism.

From 1913 to 1920 there were 1,556 cases of abortion, of which 30.2 per cent had fever. Of these, 262 had an admission temperature of from 98.8° to 100.2°, while 205 had a temperature of over 100.2°.

There were 45.5 per cent in the third month of gestation, 27.9 per cent in the second.

There were 436 uncomplicated cases. Of these, 145 were treated actively, 186 expectantly (curettage after the temperature came down), and 105 conservatively. The usual wait before curettage was three to four days. In half the cases with low fever, curettage was performed earlier.

With an admission temperature over 38° C. a longer preoperative period was allowed. The average wait was 1.6 days for temperatures of from 98.8° to 100.2°, and 2.3 afebrile days for patients admitted with temperature over 100.2°.

The duration of bleeding among 62 actively treated cases was 3.6 days, as compared with 4.3 days among 126 expectantly treated cases.

The salient data from his report are given in Table IV.

His figures show the advantage of conservative handling of the cases. These are compared with Missler's and Traugott's data. Missler's

TABLE IV

	ACTIVE CASES		EXPECTANT CASES	
	98.8°–100.4°	Over 100.4°	98.8°–100.4°	Over 100.4°
Duration of fever (days)	5.8	6.9	3.9	6.9
Duration of sickness (days)	12.1	15.1	10.4	14.5
Per cent with serious sequelae	15.4	24.5	5.3	14.7
Mortality	3.5	4.8	0	2.4

(1920) figures for duration of illness of expectantly and actively handled cases are 11.9 and 14.5 days; Traugott's (1914) corresponding data are 13.4 to 24 days. He cites Hamm's figures (1917) as 7.2 days as the duration of treatment for actively handled cases.

Prinzung also cites morbidity and mortality figures of other German writers, relating presumably to the treatment of septic abortion. The data are given in Table V.

TABLE V

	MORBIDITY		MORTALITY	
	Active	Expectant	Active	Expectant
Benthin (Königsberg)	29.0	9.8	9.8	0.8
Guttfield (Hamburg)	11.4	11.0	4.1	3.6
Missler (Giessen)	13.8	6.5	3.8	0
Traugott (Frankfurt)	14.2	2.9	18.1	2.2
Unterberger (Königsberg)	——	——	10.8	0

Universally, these figures also favor expectant treatment. Prinzung believes that cases of septic abortion should be conservatively managed.

Funke[19] (1922), presents a summary of the experience with 590 cases of abortion dealt with at the maternity institution at Cassel. These cases were cared for from 1912 to 1921. In their experience, abortions occurred most frequently in the third month of pregnancy. The treatment accorded the patients was based on the clinical picture presented rather than on the results of any bacteriologic examinations. The admission temperature of 375 clean cases was between 37.1° and 37.9° C. (98.8° to 100.2° F.); 84 cases came in with a temperature of 38° C. (100.4° F.) or more. Curettage was performed in 476 cases, seven days being the average period of stay of those with active treatment. He believes that conservative management gives good results, but that with curettage the course is shorter.

Among the recent German reports is one of Schmitt,[20] of Wurzburg (1922), in which an experience with 1,017 abortions is described, covering the years 1912 to 1921. Twenty-two and a half per cent of these cases had fever, the criterion of fever being taken as 38° C. (100.4° F.) in the axilla. Afebrile cases were given active treatment, while complicated, febrile cases were cared for conservatively. If the cases were febrile but uncomplicated, active treatment was put into effect without regard to the bacteriologic findings if there was considerable bleeding, and if the cervix was sufficiently dilated. If the patients were febrile

and uncomplicated, with but little hemorrhage and with a closed cervix, they were treated expectantly until the temperature fell or the abortion completed itself.

Schmitt cites 788 afebrile cases, of which number 705 were actively treated. A feverless course followed in 95 per cent, while 4.9 per cent ran a temperature. The mortality was 0.43 per cent due to one case of sepsis which was apparently in progress on admission, though the temperature did not indicate it, and to two cases of embolism. Of the 83 afebrile cases treated expectantly, 93.9 per cent ran a fever-free course. There were no deaths or complications.

Out of 229 febrile cases, the incidence of criminal abortion was 14.4 per cent. There were 163 actively treated, 44 expectantly, 5 actively after having become afebrile, and 17 conservatively on account of complications. Of the actively treated cases, 65.0 per cent became fever-free at once. Eleven per cent had more than one day of fever below 100.4° and a similar number more than one day above 100.4°. The mortality was 5.5 per cent.

The 44 febrile patients who were treated expectantly had a closed cervix and were not bleeding. After spontaneous abortion, the temperature came down in 25 per cent of the patients, although 75 per cent of the others ran a temperature. There were 22.7 per cent with a temperature up to 100.4° on more than one day and 40.9 per cent with temperature higher than this on more than one day. Complications arose in 13.6 per cent of these cases. There were two deaths, which, however, were not related to the specific method of treatment.

Schmitt concludes that for the actively treated cases the temperature falls more quickly, there are less complications, and fewer days of fever. The cases had a higher mortality, although he points out that in the 9 cases of death occurring in this group, 6 had had severe exhausting hemorrhage. He believes one method or the other will prove effective, depending on the proper selection of the case. If the cervix is open, and the infection is limited to the uterus, he suggests active treatment. If the infection is outside the confines of the uterus, conservative management is better, unless there is severe bleeding. For the private physician he recommends active treatment in cases uncomplicated by fever.

Bovin[21] (1923), writing on the expectant treatment of incomplete abortion, reports a mortality of 1.3 per cent in 1,141 febrile cases in which 54 per cent were treated expectantly. In 518 cases with active intervention, the mortality was 2.9 per cent. In 206 cases intervention was mandatory because of hemorrhage. In this group the mortality was 2.4 per cent.

In 156 febrile patients in whom the uterus was evacuated after the fever subsided, the mortality was 1.9 per cent. In 75 febrile patients where subsidence of fever was not awaited, 8 per cent died. His experi-

ence indicates that it is safer to wait at least six days after the subsidence of fever before evacuating the uterus. He believes the danger of spreading the infection through active measures is graver than the danger from the focus of infection lying quietly in the uterus.

Lovrich[22] (1923), reports a mortality of less than 1 per cent in the conservative treatment of 324 cases of incomplete abortion. He gives one gram of quinine and an equal amount of diethylmalonylurea in one day, divided in five doses. When the pains start three or four intravenous injections of pituitary preparation are given at from ten to fifteen minute intervals.

Nacke,[23] of Berlin (1923), is also an advocate of active intervention. He states that for cases of abortion with temperature, the uterus must be emptied as rapidly as possible, under anesthesia.

Elkan[24] reports (1923) on an experience in Hamburg with 60 cases in two years. He says the higher the temperature, the more conservative the treatment. Most of the patients received a digital curettage. He divides his classes as follows: Class 1: Short onset; bleeding; no temperature; not aborted (active therapy). Class 2: Onset six to ten days before; some bleeding; aborted; fever (conservative treatment). The temperature in this group usually falls on the second or third day. Class 3: Onset six to twenty days before; no bleeding; cervix open and complications present (conservative treatment).

Finally, the results of Ballhorn,[25] of Frankfort, will be cited. He reports (1923) on a series of cases treated at the University Clinic from 1909 to 1922. There were 3,198 fever-free cases. Ten per cent gave sterile uterine cultures; 32 per cent had streptococci; the rest had other organisms. Table VI gives Ballhorn's figures for this group.

TABLE VI

METHOD	CASES	DAYS TREATED	MORBIDITY
1 Conservative	1,476	9.3	2.4
2. Active after bacteria-free	203	15.4	1.5
3. Active	1,519	9.1	1.6

There was no mortality. The figures favor active treatment. There were in addition to these 1,137 patients who came in with fever. The results with this group are shown in Table VII.

TABLE VII

METHOD	CASES	DAYS	MORBIDITY
1. Conservative	524	15.7	9.4
2. Late active	101		
3. Active	512	10.8	8.0

The mortality in this entire group was 3.5 per cent. The morbidity was greater among those who had streptococci present in the cultures.

He believes the bacteriologic examination is of importance. He concludes that after streptococci have disappeared or after an afebrile period of three to five days, favorable results on emptying the uterus can be secured. Only with severe bleeding is immediate interference desirable. He uses the finger and dull curette and regards disinfection as worthless.

We will now review the case records of the Woman's Hospital, reserving discussion for a subsequent section.

ANALYSIS OF CASE RECORDS AT THE WOMAN'S HOSPITAL

The present study was limited to cases of incomplete abortion, as based on the final diagnosis appearing on the hospital records. Cases with questionable retained secundines were ruled out, as well as those of inevitable or complete abortion.

During the period extending from September, 1919, to January, 1924, there were 311 such cases. These were admitted to the ward services of various attending surgeons and many were private cases. The choice of method of treatment rested with the surgeon, there being no set procedure for the handling of these cases which all had to follow.

TABLE VIII

METHOD OF MANAGEMENT OF 311 CASES OF INCOMPLETE ABORTION ADMITTED FROM SEPTEMBER, 1919, TO JANUARY, 1924

METHOD	NUMBER OF CASES	PER CENT OF TOTAL
Dilatation and curettage	212	68.2
Curettage without dilatation	8	2.5
Dilatation and curettage and other simultaneous operation*	33	10.6
Other operations	3	1.0
No operative treatment	49	15.4
Refused operation	4	1.3
Septic cases, untreated	2	0.6
Operatively treated	256	82.3
Nonoperatively treated	55	17.7
Total Cases	311	100.0

*Among these were insertion of radium pack, retroversion corrections, laparotomies, amputations of cervix, repair of pelvic floor and other gynecologic operations.

General Management of the Cases.—Reference to Table VIII will indicate how the cases were managed. Of the total 311 patients, 212, or 68.2 per cent had a dilatation and curettage for the removal of the retained secundines. This curettage usually was done with a curette, the uterus being later packed with iodoform gauze. Several patients were curetted alone, the os of the cervix not requiring dilatation. In addition, there were 33 patients who had a dilatation and curettage with another simultaneous operation.

As it is proposed to compare the length of stay of cases treated operatively and those treated conservatively, this group of patients with more than one operation is considered separately. However, the dilatation and

curettage was applied to these patients for the incomplete abortion. The total number of patients having the uterus emptied was 253, or 81.3 per cent of the total.

There were 49 patients who received no operation at all, being treated conservatively. Some in this group were packed, but many of them received only symptomatic treatment. One of these is described as having the "uterus emptied," but not operatively. This group constitutes 15.4 per cent of the total.

The conservatively treated cases were fairly well distributed among the four divisions of the hospital, which during the period of time covered were headed by five different surgeons. One of these had 16 of the 48 cases. The others had 8, 7, 6 and 5, the balance being distributed among single individuals.

Three patients received other operations entirely, although among the final diagnoses of these cases appeared "retained secundines." Four patients refused operation, and these cases are excluded from some of the statistics which follow.

Summarizing the management of these cases, it may be said that 82.3 per cent received operative treatment, as compared with 17.7 per cent receiving no operative treatment, a ratio of 4.7 to 1.

Method of Abortion.—In the treatment of incomplete abortion cases admitted to a hospital for care, it is of paramount importance to learn how the abortion occurred. The immediate treatment accorded to a frankly spontaneous and clean case of abortion would no doubt be different from that which would be given to one which was induced and probably contaminated.

For this reason an attempt was made to classify the method of abortion of the 311 cases admitted, as shown in Table IX. The histories indicated

TABLE IX

METHOD OF ABORTION OF PATIENTS ADMITTED WITH HISTORY OF INCOMPLETE ABORTION

METHOD	NUMBER
Spontaneous	289
Induced by drugs or instruments	7
Abortions said to be associated with falls or accidents	15
Total	311

that but 7 admitted an induction of the abortion. By far the largest number appeared to be spontaneous. Too much credence cannot, of course, be given to all statements regarding this occurrence, but it would appear, nevertheless, that most of the abortions did arise more or less spontaneously.

Chief Compliant on Admission.—A tabulation was made of the chief complaint for which these patients sought relief. By far the largest

TABLE X

COMPLAINT	NUMBER OF CASES
Bleeding and prolapse of cord	1
Bleeding	225
Pain and bleeding	37
Pain	16
Bleeding and miscarriage	9
Bleeding and fever	6
Vaginal discharge	3
Pain and discharge	2
"Spontaneous abortion"	2
Chills and fever	1
Tumor	2
Shortness of breath	1
Bleeding and prolapse of cord	1
"Toxemia"	1
"Repeated miscarriage"	1
Not stated	4
Total	311

TABLE XI

PARITY OF 311 CASES OF INCOMPLETE ABORTION

PARITY	NUMBER
No previous children	98
Para 1	81
2	54
3	28
4	19
5	13
6	2
7	5
8	1
9	1
Not stated	9
Total	311

TABLE XII

HISTORY OF EARLIER ABORTIONS OR MISCARRIAGES IN 311 CASES ADMITTED WITH RECENT ABORTION

NUMBER OF ABORTIONS	CASES
None	153
1	83
2	38
3	19
4	3
5	2
6	3
7	1
10	1
14	1
Not stated	7
Total	311
Total with previous abortions	151

proportion came into the hospital on account of the bleeding or because of pain and bleeding as shown in Table X.

Parity.—It is of interest to note that out of the 311 patients, there were 213 or 68.5 per cent who had had previous children. A little over 40 per cent had more than one child.

History of Earlier Abortions.—Of still greater interest, however, is Table XII, which shows that approximately half the total number of patients gave a history of one or more previous abortions or miscarriages. There were 21.5 per cent or about one-fifth of all the patients who had failed on more than one previous occasion to carry a pregnancy through to term.

Month of Gestation.—Tables XIII and IV give the time in months of gestation at which the abortion occurred in the cases under consideration. Referring to Table XIV, which is a summary of Table XIII, it will be noted that in 23 per cent of the cases the period of gestation was less than

TABLE XIII

MONTH OF GESTATION WHEN ABORTION OCCURRED IN 311 CASES WITH INCOMPLETE ABORTION

MONTH OF GESTATION	NUMBER OF CASES
Under 1	7
1.0	30
1.5	29
2.0	90
2.5	28
3.0	56
3.5	10
4.0	21
4.5	3
5.0	5
6.0	7
7.5	1
Not determined	24
Total	311

TABLE XIV

CONDENSED RECORD OF MONTH OF GESTATION WHEN ABORTION OCCURRED IN 311 CASES OF INCOMPLETE ABORTION

(FROM TABLE XIII)

MONTH OF GESTATION	NUMBER OF CASES	PER CENT OF TOTAL
Less than 2 months	66	23.0
Between 2 and 3 months	118	41.1
Between 3 and 4 months	66	23.0
4 months and over	37	12.9
Total	287*	100.0

*Exclusive of undetermined cases.

two months. Over 40 per cent of the patients aborted between the second and third month. Approximately another quarter aborted between the third and fourth month of pregnancy.

While it was not possible to secure accurate information on this point in all cases, it is of interest to note that of the cases in which the facts were stated, directly or indirectly, 87.1 per cent aborted before the fourth month. This is quite in agreement with the general experience of others.

The figures have a definite significance in the light of preventive medicine. They reflect, in part, the importance of improved maternity hy-

giene and prenatal care. The potential waste of life and the concomitant physical distress involved are factors worthy of extended effort in the prevention of abortions.

Time Interval Between Abortion and Admission.—The most prominent purpose for which relief is sought by these patients at the hospital is irregular bleeding. This metrorrhagia usually dates from the time when the abortion occurred, though many of the patients cannot state this positively. It is, however, the usual occurrence.

It is surprising indeed to observe how long a time this bleeding may persist before adequate relief is sought or obtained. The data bearing on this point are given in Table XV.

Of 225 patients with operative treatment, there were 78 who had aborted one week before or a shorter period before admission. This constitutes 30.6 per cent of this group of cases. A much larger number, namely 177 or 69.4 per cent waited longer than a week before coming to the hospital. There were 65 patients who had an interval of one to three weeks. The number who had a lapse of a month or more before seeking relief at the hospital was 80, or approximately one-third of the operatively treated cases.

TABLE XV

TIME INTERVAL BETWEEN DAY OF ABORTION OR BEGINNING OF BLEEDING AND DAY OF ADMISSION TO THE HOSPITAL FOR TREATMENT OF INCOMPLETE ABORTION

DURATION OF BLEEDING	CASES TREATED OPERATIVELY	CASES TREATED NONOPERATIVELY
Under 1 day	10	1
One day	19	8
2-7 days	49	12
8-14 days	35	8
15-21 days	30	2
4 weeks	19	3
5 "	9	0
6 "	16	2
2 months	17	3
3 "	13	5
4 "	3	–
5 "	2	–
7 "	1	–
Not determined	32	4
Total	255	48

A somewhat similar situation existed among the 48 conservatively treated patients. One of the 49 conservatively treated patients had a rectal tube inserted in the uterus under aseptic precautions. This, however, involved some intrauterine interference and it will be excluded from the conservative group, reducing the number to 48. There were 21, or 43.8 per cent who came not later than one week after the abortion. There were 10, or about one-fifth, who came in after the second or third week. Thirteen of the 48 conservatively treated patients aborted one or more months before entering the hospital. Attention is called to the fact that

a good many women in both the actively and conservatively managed groups had aborted two or more months before coming to the hospital for care.

Admission Temperature.—The item of temperature on admission in a case of incomplete abortion received in a hospital is of very great importance, for it gives the attending physician valuable information and may decide the course of action. A case of this type with an admission temperature of, say, 103°, may be regarded as septic. On the other hand, one admitted with a normal temperature soon after the abortion may prove later to have been infected, the subsequent rise in temperature giving the telltale evidence.

TABLE XVI

DISTRIBUTION OF ADMISSION TEMPERATURES

TEMPERATURE	CASES TREATED OPERATIVELY	CASES TREATED NONOPERATIVELY
Below 98°	10	5
98°-99°	128	13
99°-100°	85	18
100°-101°	22	9
101°-102°	6	1
102°-103°	4	1
Over 103°	–	1
Total	255	48
Per cent below 100°	87.5	75.0
Per cent above 100°	12.5	25.0

Special attention has here been given to this point of admission temperature.

Table XVI gives the admission temperature of the cases given conservative or operative treatment. The temperatures are mouth temperatures. Gordon[13] considers his patients with a rectal temperature of 101° as septic. This would correspond to a mouth temperature of 100°, which has been taken as the dividing line here. In this paper we have regarded as a condition of "fever" a mouth temperature of 100° or more.

It will be seen from Table XVI that most of the patients under consideration had no temperature on admission. Of the operated cases, 138, or 54 per cent, had a temperature of less than 99°. Eighty-five had a temperature of 99° but less than 100°. A total of 87.5 per cent of the operated cases had no temperature on admission, or a temperature below 100°. Only 12.5 per cent, or one-eighth, had a temperature of 100° or over.

The patients treated expectantly had a relatively higher proportion among them of fever on admission. Three-quarters of them, however, 75 per cent, had no temperature at all when admitted. Twenty-five per cent did have a temperature of 100° or more. This was twice the percentage of those with temperature on admission who were actively treated.

Pre- and Postoperative Temperature in Relation to Treatment.—Hillis[12] stated that in his experience patients operated on with a temperature, or before they were free of temperature for five days before operation, ran a longer postoperative temperature than the fever-free cases similarly treated.

In the cases treated at the Woman's Hospital there is no fixed policy of waiting for a definite number of feverless days. However, in most of the cases, there was no temperature at the time of the operation. It was almost universally the custom to wait until the admission temperature fell before operative intervention.

In Table XVII there is a comparison of the number of days of preoperative temperature and postoperative temperature. This table is limited to the patients with dilatation and curettage or curettage alone. A similar table is presented for the 33 patients who had a dilatation and curettage and other operation at the same time, since these were not purely incomplete abortion cases but were complicated cases as well.

TABLE XVII

NUMBER OF DAYS WITH TEMPERATURE OF 100° OR MORE BEFORE OR AFTER OPERATION

A. Cases with Dilatation and Curettage or Curettage Only

NUMBER OF DAYS	BEFORE OPERATION (NUMBER)	AFTER OPERATION (NUMBER)
0	180	101
1	26	64
2	10	35
3	2	15
4	0	2
5	1	2
Total	219	219
	Per cent	Per cent
0	82.2	46.1
1	11.9	29.2
2	4.6	16.0
3	0.9	6.9
4	0.0	0.9
5	0.4	0.9
Total	100.0	100.0

From Table XVII it will be noted that 180, or 82.2 per cent of the total cases did not have any temperature before operation. Only a small number of the patients had one or more days of preoperative temperature. But 16.5 per cent had one or two days of fever at 100° or more before curettage. The average number of days of preoperative temperature of 219 cases was 0.26 days per patient.

The last column of Table XVII shows the distribution of postoperative temperature days of the curetted cases. Almost half of the patients, namely, 46.1 per cent, ran no temperature at all. Sixty-nine patients, or 45.2 per cent, ran a postoperative temperature on one or two days. This would seem scarcely more than what one would expect with any

operation. It can be said, therefore, that the great majority of these patients ran either no temperature, or a very short course of fever, 201 of the cases or 91.3 per cent falling in this class. Only 8.7 per cent of the patients had three or more postoperative days of temperature. Only four patients ran a temperature on four or five days. The average number of days of temperature after the operation was 0.9 of one day, or approximately one day.

These data would tend to show that in the experience of straight cases of incomplete abortion which were treated by dilatation and curettage, the average duration of temperature before operation was 0.26 days and the average duration of postoperative temperature was 0.9 days.

TABLE XVIII

NUMBER OF DAYS WITH TEMPERATURE OF 100° OR MORE BEFORE OR AFTER OPERATION
B. Cases with Dilatation and Curettage and Other Simultaneous Operations

NUMBER OF DAYS	BEFORE OPERATION	AFTER OPERATION
0	26	4
1	5	8
2	1	6
3	1	4
4	–	7
5	–	1
9	–	2
12	–	1
Total	33	33

In Table XVIII similar data are presented for the patients who had more than one operation. Almost all of them, 31 out of 33, had either no temperature or only one day of fever before operation. It is to be expected that these patients would experience a longer postoperative temperature, many of the operations having been laparotomies. The average number of postoperative temperature days in this group was approximately three days.

Turning now to the conservatively treated patients for whom the data are in Table XIX, it will be noted that 28 out of the total 48, or 58.3 per cent, at no time had a temperature of 100°. The others all had temperature for a variable number of days, the largest group having a temperature on three days. The average number of days of temperature of these nonactively treated patients was 1.8 days. The corresponding number of postoperative days with temperature for the straight curetted cases was 0.9 days. In other words, the conservatively treated cases had a longer course of temperature than the actively treated cases.

Number of Days in the Hospital in Relation to Treatment.—The foregoing section dealt with the number of *days of temperature* before and after operation of the variously treated cases. The following paragraphs are concerned with a consideration of the *total days in the hospital* before and after treatment. As before, the simple curetted patients are sepa-

TABLE XIX

NUMBER OF DAYS ON WHICH CASES HAD A TEMPERATURE OF 100° OR MORE WHILE IN HOSPITAL

C. Cases Treated Without Operation

NUMBER OF DAYS	NUMBER OF CASES
0	28
1	4
2	3
3	5
4	2
5	1
6	2
8	1
11	1
15	1
Total	48

rated from those with multiple operations, and from the expectantly treated patients.

Reference to Table XX shows that the majority of the patients who received a dilatation and curettage were in the hospital four days or less before emptying of the uterus of the retained secundines. There were 25 patients out of 219 who were curetted at once, no doubt because of severe bleeding. There were 67, or about a third, who were in the hospital but one day before curettage. These two groups combined make a total of 92 cases, or 42.0 per cent of all the cases. The average number of preoperative days per patient was 2.9 days.

In connection with the postoperative stay of these curetted patients, the last column of Table XX shows that the general range was from five

TABLE XX

NUMBER OF DAYS IN HOSPITAL BEFORE AND AFTER OPERATION

A. Cases with Dilatation and Curettage or Curettage Only

NUMBER OF DAYS	BEFORE OPERATION (CASES)	AFTER OPERATION (CASES)
Part of a day	25	0
1	67	0
2	40	0
3	20	6
4	25	8
5	17	26
6	11	29
7	3	30
8	2	22
9	2	31
10	2	21
11	0	12
12	1	12
13	1	6
14	2	7
15	0	3
16	0	3
17	1	0
20	0	2
Total	219	219

to nine postoperative days. There were 138 patients, or 63.0 per cent, who left the hospital on the fifth to the ninth postoperative day. The average stay of all these cases was 8.7 postoperative days. The average total stay was 11.6 days.

Curetted Cases with Prolonged Stay.—Some of the patients with a simple curettage spent a much longer time in the hospital than others. Table XX shows that there were eight patients who had more than a two-week postoperative stay. The salient particulars in regard to these cases as gleaned from their records are as follows:

CASE NO. 33113.—A second admission one month after a previous curettage, oophorectomy, and appendectomy. Had a red vaginal discharge since. Readmission temperature, 98.2°. Curetted on day of admission. Had pain in right abdomen on tenth to thirteenth postoperative day. In hospital fifteen days.

CASE NO. 29770.—Came to the hospital with pain and bleeding, having lost some fluid twenty-four hours previously. Expelled a three months fetus two and five tenths hours before admission. Admission temperature, 102.2°. Was curetted the next day. Had three days of postoperative temperature. In hospital fifteen days.

CASE NO. 28586.—This patient was admitted with a temperature of 99.4° after bleeding for twenty-one days previously. She was packed at once and on the next day expelled the pack and clots. Had two days of temperature. Dilatation and curettage four days after admission. Had a postoperative temperature on three days. In hospital sixteen days.

CASE NO. 31488.—Admitted to the hospital with pain and spotting and temperature of 98.8°. Had also myoma uteri. Was in the hospital six days before curettage. Had lochia rubra for six days after and four days of postoperative temperature. Syphilitic. In hospital sixteen days.

CASE NO. 30329.—Admission temperature was 99.0°. Was observed five days before curettage, although there was no preoperative temperature. Owing to continued bleeding after the operation, the curettage was repeated three days later. Had four days of postoperative fever. Was in hospital sixteen days.

CASE NO. 28933.—An uncomplicated case with a history of irregular bleeding, lasting three months. Just before admission she had expelled a fetus, previous to which there had been five days of bleeding. Admission temperature was 99.0°. No preoperative temperature. Dilatation and curettage on fourth day. Ran a flat temperature for twelve days before leaving the hospital, but until the day before had a persistent, small amount of brownish discharge. In hospital seventeen days.

CASE NO. 23995.—This patient had been bleeding ten days before entering the hospital. Admission temperature, 98.8°. The cervix admitted two fingers and the placenta was presenting. After digital curettage and iodoform pack the day after, she remained in the hospital twenty days, with but one day of temperature. There was no obvious reason for the protracted stay.

CASE NO. 32719.—Aborted eighteen days before coming to the hospital. Entering temperature, 99.4°. On the third day she was curetted. Had fever three days before. Had a lochia rubra for fourteen days. In hospital twenty days.

A review of these cases points to the conclusion that the general reason for holding these patients over in the hospital was not because of fever or complications, or other unfavorable sequelae of a curettage. In half

the cases the extra stay was because of a somewhat prolonged flow of red lochia.

The date regarding hospital period for patients with curettage plus a second operation appear in Table XXI. About half of these were operated on before the third day, indicating that the presence of an incomplete abortion did not deter the surgeon from caring for the patient operatively at an early date. The average preoperative stay of these patients was 2.9 days. This is exactly the same as that accorded to the simple curettage cases.

TABLE XXI

NUMBER OF DAYS IN HOSPITAL BEFORE AND AFTER OPERATION

B. Cases with Dilatation and Curettage and Other Simultaneous Operations

NUMBER OF DAYS	BEFORE OPERATION	AFTER OPERATION
1	13	0
2	2	0
3	6	0
4	4	1
5	3	2
6	2	1
7	0	3
8	1	2
9	1	0
10	0	4
12	0	2
13	0	2
14	0	2
16	0	3
17	0	3
18	0	1
19	0	2
21	0	2
27	0	1
33	0	1
34	0	1
Total	33	33

On the other hand, the subsequent stay after operative treatment was longer. This is to be expected, as the come-back after more extensive surgical treatment is longer than that after the more simple procedures. The postoperative sojourn of these patients varied from four to thirty-four days. The average number of postoperative days was 14.1 days.

Considering now the days in the hospital of the conservatively handled cases, Table XXII shows that the total stay varied from two days to thirty-one days. Thirty-five of these patients, or 72.9 per cent, were out of the hospital by the fourteenth day. The remaining number had a more protracted period of hospitalization. The average number of days in the hospital for this class of case was 11.8 days. This is practically the same as the average total hospital stay of the simple curetted patients, which was 11.6 days.

Expectantly Treated Cases with Prolonged Stay.—In view of the lengthy stay in the hospital of some of these cases it is of interest also

TABLE XXII

TOTAL NUMBER OF DAYS IN HOSPITAL OF CASES WITH NO OPERATIVE PROCEDURE

NUMBER OF DAYS	NUMBER OF CASES
2	2
3	2
4	1
5	1
6	4
7	3
8	6
9	1
10	5
11	2
12	2
13	6
15	1
16	3
17	1
18	1
20	2
22	1
23	1
28	1
30	1
31	1
Total	48

to inquire more closely into the individual records, as was done above in the case of the curetted patients who remained in the hospital over two weeks. Such a close scrutiny of the records may possibly throw light on phases of the particular method of treatment.

There were 13 conservative cases with a stay in the hospital of over two weeks. The following brief notes indicate why these individuals had a protracted stay:

CASE No. 30774.—The patient induced the abortion by means of slippery elm stick. She had been bleeding for three months. After having been in the hospital six days, the fetus was expelled. She ran a temperature for five days after this. In hospital fifteen days.

CASE No. 30632.—Aborted on day before admission. Had no temperature at any time; the admission temperature was 99.0°. Lochia rubra for eight days. She was in the hospital fifteen days.

CASE No. 31147.—This patient gave a history of bleeding for three months before coming to the hospital. Temperature on admission, 98.6°. She was in the hospital four days when she spontaneously expelled a fetus. The placenta was expressed. She had lochia rubra for seven days. She was syphilitic. Total hospital stay, sixteen days.

CASE No. 28304.—Induced abortion by means of a catheter three days before admission. The admission temperature was 100.8°. She expelled the fetus at once and ran a temperature for three days. In hospital sixteen days.

CASE No. 32870.—Had been bleeding for two and a half months before admission. Was admitted with a temperature of 99.6° and was packed immediately. On the fifth day the uterine contents came away. At no time was there fever. In hospital sixteen days.

CASE No. 32597.—Had a temperature two days before admission. The abortion occurred on the day of admission, but the placenta was retained. This was found lying in the vagina twenty-four hours later, and was removed by hand. The patient had a brownish vaginal discharge for fifteen days.

CASE No. 29770.—Began to bleed ten hours before admission. Came in with a temperature of 99.4°. Ten minutes after entering the ward the fetus was spontaneously expelled. The temperature course was smooth, but the lochia was red for eleven days. She remained in the hospital twenty days.

CASE No. 30952.—Aborted on day before admission and at no time ran any temperature. Admission temperature was 99.2°. Was packed to control bleeding. Lochia rubra for twelve days; hospital stay eighteen days.

CASE No. 30471.—The abortion occurred one month before entering the hospital; temperature 99.2° on admission. Had to be transfused. Had lochia rubra eighteen days; twenty-two days in the hospital.

CASE No. 27074.—This patient entered the hospital with bleeding and fever. The admission temperature was 105.4°. The patient ran a temperature for fifteen days and was in the hospital twenty-three days altogether.

CASE No. 31524.—A curettage was performed on this patient two weeks before admission. Entered with a temperature of 97.8°, and had no temperature while in the hospital. Had a vaginal discharge for but three days but was watched for twenty-seven and five tenths days.

CASE No. 26346.—Was bleeding for six days before admission and came in with a temperature of 100.2°. She ran a septic temperature for eight days and was in the hospital one month.

CASE No. 27570.—This case had been curetted outside, and came in with a temperature of 100.6°. While in the hospital she expelled clots and ran a temperature for eleven days. She was watched a month also.

It will be seen from the foregoing records that these patients were closely watched, mainly because the abortion was induced or because there was a curettage on the outside, or because of prolonged red lochia or obvious infection. It would seem that operative interference was definitely contraindicated in these cases and that conservative management was essential.

Relation of Immediate or Delayed Curettage to Postoperative Temperature.—We have considered above the number of days of postoperative temperature of *all* of the cases. For the simple curetted cases this was 0.9 days. For the patients curetted and operated on for something else besides, it was three days. Finally, for the conservatively handled cases the average number of days of temperature was 1.8 days.

It is proposed in the present section to consider only the first group of these patients, namely those who received a simple dilatation and curettage. There were 219 such cases. The data have been submitted to a closer scrutiny in order to determine whether the patients who received an early curettage fared better or worse than those who were permitted to wait a while. Table XXIII aims to give such a "close-up" of curet-

TABLE XXIII

NUMBER OF POSTOPERATIVE DAYS WITH TEMPERATURE OF 100° OR MORE IN RELATION TO NUMBER OF PREOPERATIVE DAYS IN HOSPITAL

Patients with Dilatation and Curettage

NUMBER OF POSTOPERATIVE DAYS WITH TEMPERATURE	NUMBER OF PREOPERATIVE DAYS		
	0, 1, 2	3, 4	5 or more
0	67	16	16
1	37	14	11
2	17	11	10
3	8	4	3
4	1	0	2
5	1	0	1
Total	131	45	43
Average number of days with temperature	0.8	1.1	1.2
Total with 2 or less days of temperature	121	41	37
Per cent with 2 or less days of postoperative temperature	92.4	91.1	86.1

tage. It aims to answer the question, how is the postoperative temperature course affected by operating at once or after three or four days, or after five or more days following admission?

The table shows that early operative interference in the cases met with at this hospital had no deleterious effect whatever on the temperature course after operation. Out of 131 cases operated, either without delay or after but one or two days of waiting, 67 or approximately half the number had no postoperative temperature over 100°. In the other two groups, operated either after three to four or five or more days, but 16 in each group of 45 and 43 cases respectively were entirely devoid of temperature, a proportion more nearly one-third than one-half. The last two lines of Table XXIII also bring out the fact that postponed curettage has no advantage over immediate action, as far as postoperative temperature is concerned. Of the patients whose curettage was deferred five or more days after admission, 86.1 per cent had two or less than two days of postoperative temperature. The corresponding percentage was 91.1 for those who were curetted after a period of three or four days. On the other hand, the best postoperative temperature record occurred among those who were curetted earliest. Out of 131 patients, 121 had a temperature on two or less than two days, a percentage of 92.4 per cent.

Effect of Immediate or Delayed Curettage on Length of Postoperative Hospital Stay.—It was noted above that the total length of the hospital course of the patients with a dilatation and curettage was on the average 11.6 days and that 8.7 days was the average length of the postoperative course of all the patients. Does an early curettage cause a longer or shorter postoperative stay? The answer to this question is suggested in Table XXIV, which is, like the foregoing table, a "finer focus" of an earlier general table.

TABLE XXIV

NUMBER OF POSTOPERATIVE DAYS IN RELATION TO NUMBER OF PREOPERATIVE DAYS IN HOSPITAL

Cases with Dilatation and Curettage

NUMBER OF POSTOPERATIVE DAYS	NUMBER OF PREOPERATIVE DAYS		
	0, 1, 2	3, 4	5 or more
1	1	0	0
3	6	0	0
4	7	1	1
5	19	2	4
6	21	3	4
7	22	6	3
8	12	2	7
9	14	11	6
10	8	6	7
11	6	4	3
12	5	3	4
13	4	2	0
14	3	2	1
15	2	0	1
16	0	2	1
20	1	1	0
Not stated	0	0	1
Total	131	45	43

Table XXIV separates the patients who were operated on the same, first or second day from those operated on the third or fourth day, and in turn from those operated on the fifth or subsequent day. In the first group there were several patients who left the hospital before the fourth day. None of the patients in the other two groups left so early.

Since the average stay after operation for the entire group of 219 cases was 8.7, a calculation is made to determine how many cases in each of the three groups fell above or below a nine-day stay, a figure close to the general average.

TABLE XXV

CASES OPERATED AFTER	TOTAL NUMBER	TOTAL NUMBER LEAVING BEFORE 9 DAYS AFTER OPERATION	PER CENT	AVERAGE NO. OF POSTOPERATIVE DAYS
0, 1, 2 days	131	88	67.2	7.6
3, 4 days	45	14	31.1	9.6
5 or more days	43	19	41.9	8.9

The figures and corresponding percentages are given in Table XXV, together with the average stay calculated for each group.

Table XXV reveals the interesting fact that the group operated on soonest had the largest proportion of patients out of the hospital before the ninth postoperative day. The group with the delayed operative treatment came next. Those operated on after three or four days in the hospital occupied an intermediate position. Two-thirds of the patients with early operation left the hospital before the ninth day after curettage. Only one-third of those held over for three or four days before curettage were out by the ninth day.

The average postoperative stay was two days shorter for those operated before the third or fourth day than for those done after this interval, the figures being 7.6 days and 9.6 days respectively. The average number of postoperative days for the remaining group, namely, those cared for after five or more days, was 8.9 days.

It may be said that the patients operated on soonest might have been the most favorable ones to operate on early, and that therefore their postoperative stay might be expected to be short. This may, of course, be true, but the table indicates nevertheless the absence of an undesirable effect on postoperative course of an early curettage among cases of the type received at the Woman's Hospital using the methods employed.

Mortality.—Among the 311 patients admitted and diagnosed in this five-year period as having an incomplete abortion, there were two deaths. A study of the case records of these two patients shows the following:

One patient was admitted with a temperature of 98.8°, with a septic abortion. She was given no operative treatment as her temperature rose rapidly and steadily for three days, reaching 106.8° when she died. Autopsy revealed a purulent peritonitis.

The second patient was admitted in a moribund condition. Her temperature was 104.0° and on admission she had a definite lobar pneumonia and was extremely toxic. She lived only a few hours. This death may with all propriety be omitted from the records of mortality as considered here.

Neither of the patients died of any cause related to treatment given or omitted at the hospital, so that the mortality may be regarded as nil. If the one case of septic abortion is included, the percentage of mortality is 0.32 per cent, or a third of one per cent.

DISCUSSION

The experience in the management of incomplete abortion as reviewed above, is quite in accord with the results others have obtained with similar types of cases.

Most of the Woman's Hospital patients were "clean" cases without temperature. An early dilatation and curettage relieved them of the predominating symptom of bleeding, without any harmful sequelae as reflected either in the postoperative course or clinically when leaving the hospital. A brief comment upon the items studied with reference to corresponding findings of others may be of interest.

Method of Management.—A little over four-fifths of the patients (81.3 per cent) with incomplete abortion had the uterus actively emptied. This was performed usually, but not always, by means of the curette. In many of the descriptive reports of the curettage special reference was made to the fact that the evacuation was *gently* performed. This proportion of actively handled cases is far greater than that employed by

either Gordon or Hillis. In Gordon's series only 18 out of 530 were curetted. In his second series of 961 cases, only 3 per cent were curetted. In the 1,000 cases of Hillis, only 241 were curetted. On the other hand, in the series of 3,500 cases reported by McPherson, 80 per cent were actively treated. In the more recent series of Schmitt, 85.3 per cent had active treatment.

Of course, the mode of management depends on the type of case, which naturally varies at different institutions. At the Woman's Hospital where there is no ambulance service and where a relatively good economic class is received, the number of emergency cases is smaller and the type of patients better than in a municipal institution. As many as one-third of the operatively treated patients sought relief after irregular bleeding for one month or more, indicating the large proportion of patients who were not of an emergency nature.

Further, our figures refer to incomplete abortions alone, while those of others include other types of abortion as well. The figures are generally comparable however, when it is borne in mind that most cases of abortion met with at the hospitals were of the incomplete type. The proportion of such cases in the experience of others is as follows: Titus,[26] 59.12 per cent; McPherson,[2] 86.3; Hillis,[6] 76.22; Hillis,[12] 77.2; Gordon,[13] 91.0.

Parity and Month of Gestation.—Half of our cases were among women who had previously borne children. In McPherson's group only 16.5 per cent were among primipara. In Missler's group the majority were in multipara; Schmitt had a proportion of nearly 70 per cent among multipara.

In our cases 40 per cent aborted between the second and third month, 87.1 per cent before the fourth month. McPherson reports 1,320 patients out of 3,500 aborting between the sixth and twelfth week. Prinzung reports 45.5 per cent aborting in the third month, a figure which corresponds with ours.

Fever on Admission.—Most of the Woman's Hospital patients had no fever on admission. Only 12.5 per cent of curetted patients had a temperature of 100° or more; of the conservatively treated, 25 per cent. Similar findings are reported by others, although the specific temperature characterized as "fever" varies. In general the data may be compared. Vineberg and Wiener had 60 patients among 287 with a temperature over 101°; Gordon, one-sixth of 530 patients had a temperature of over 101°; Prinzung, 30.2 per cent had fever on admission; Funke, most patients admitted without fever; Schmitt, 22.5 per cent had fever. Titus in a series of incomplete abortion cases studied at the Johns Hopkins Hospital, in 1912, found that 45 per cent had a temperature over 101°. Kolde experienced a similarly high proportion of patients with fever, namely 42.9 per cent.

Days Before Active Treatment.—One-third of our curetted patients were treated after but one day in the hospital. The average preoperative stay was 2.9 days. The majority of the actively treated patients had a curettage within four days after admission. This preoperative stay is less than that proposed by Hillis and others. It falls within the same period as Prinzung reports, namely, 1.6 preoperative days for cases with a temperature between 98.8° and 100.2°, and 2.3 afebrile days for patients with temperature over 100.2°.

Preoperative Temperature.—The average duration of temperature in our cases before operation was but 0.26 days. This relatively short period undoubtedly contributed to the short preoperative period.

Postoperative Temperature.—Almost half of our patients with curettage ran no temperature at all after the operation, while 45.2 per cent ran a postoperative temperature on only one or two days. But 8.7 per cent had a temperature on more than three postoperative days. The average duration of temperature was 0.9 days. Of the conservatively handled patients, the average days of temperature was 1.8, while 58.3 per cent never had a temperature over 100°.

The absence of a febrile reaction in a majority of afebrile patients submitted to curettage has also been observed by others, as noted above —namely, by King, Ashhurst, Hillis. The latter noted that with a five-day afebrile period 95 per cent gave no rise in temperature after curettage. Schmitt's figures show a 95 per cent feverless course in 705 afebrile curetted cases. In Missler's series, 60 per cent had no postoperative temperature, if the preoperative temperature was flat. Kolde's patients ran a smooth course with a quick drop in temperature after curettage in 72.4 per cent of his cases.

The total days of temperature in our patients seem less than that reported by many others who have recorded this observation. Our average figure is less than two days for both active and conservatively treated cases. Missler's patients ran eight days of temperature in the actively treated group and 3.4 days in the conservative group. Prinzung's figures are 5.8 and 6.9 days for actively treated cases, with low and high admission temperatures, and 3.9 and 6.9 days for expectantly treated cases with low and high admission temperatures respectively.

Length of Hospital Stay.—Our curetted patients without secondary operations had an average total stay of 11.6 days. The nonoperated patients had a stay of 11.8 days on the average. Corresponding figures obtained by others are given in Table XXVI.

The figures for the curetted patients range from seven to twenty-four days. Too much significance should not be attributed to these figures, since there are many factors besides clinical improvement which may influence hospital stay in different institutions. Some institutions may wish to dispose of their cases early, while others may wish to watch them a little longer.

TABLE XXVI

	CURETTED CASES	LATE CURETTED	NONCURETTED
Gordon	9.0		6.0 (aseptic)
Hillis	10.3		7.79
Missler	14.5	11.9	11.3
Traugott	24.0	13.4	
Prinzung	12.1, 15.1	10.4, 14.5	
Hamm	7.2		
Funke	7.0		
Kolde	8.0		
Ballhorn afebrile	9.1	15.4	9.3
febrile	10.8	15.7	
Woman's Hospital	11.6		11.8

Comparing the length of stay for the two types of treatment, it is of interest to note that the conservatively treated cases have a shorter stay in three out of five instances. Moreover, where the stay is longer, it is only a fraction of a day longer. In point of time, therefore, conservative treatment does not, on the average, require a longer stay than active treatment.

Mortality.—While our mortality may be set down as 0.32 per cent, it is not altogether fair to compare this very low mortality with the mortality experienced by others without more regard to the specific cases received at the different institutions. For the two different methods of treatment, the mortality has usually been higher in the operatively treated cases, especially in those with fever. The figures in per cent recorded by others are here assembled for convenience of reference: McPherson, 1.8 in all cases; Vineberg and Wiener, 3.0 in all cases; Hillis, 0, in aseptic cases; Hillis,[6] 3.0 in curetted, 1.0 in noncuretted cases; Hillis,[12] 1.24 in curetted, 2.24 in noncuretted cases; Missler, 13.8 actively treated, and 0 for expectantly treated; Kolde, 3.2 for entire series, 3.8 for actively treated; Prinzung, 3.5 for afebrile active and 4.8 for febrile active, and 0 for afebrile conservative, and 2.4 for febrile conservative cases; Schmitt, 0.43 for actively treated, 0 for conservatively treated; Bovin, 2.9 in all active cases, 1.3 in febrile cases, expectantly treated, 8.0 in febrile cases actively treated; Ballhorn, afebrile cases, 0 mortality, febrile cases, 3.5.

SUMMARY AND CONCLUSIONS

A statistical analysis of 311 case records of incomplete abortion treated at the Woman's Hospital during the course of approximately five years has been presented.

Both active and conservative methods of treatment have been employed.

The proportion of patients treated operatively was 81.3 per cent. The rest were not operated.

The abortions occurred in 87.1 per cent of the patients before the fourth month of gestation.

The time elapsing between the event of abortion and hospital admission varied from a few hours to several months; 30.6 per cent of the operated patients aborted one week or less before admission, while 69.4 per cent aborted one week or more before they sought relief. One-third of the patients had symptoms for a month or more before seeking hospital attention. The patients treated conservatively came to the hospital somewhat earlier.

Of the patients treated operatively, 87.5 per cent had a temperature on admission of less than 100°. Of the conservatively handled patients, 75 per cent had no temperature on admission.

The average duration of temperature before curettage was 0.26 days. The average duration of postoperative temperature was 0.9 days. The average days of temperature of the nonoperated cases was 1.8 days.

Of the curetted cases, 46.1 per cent ran no temperature at all; 45.2 per cent had a temperature on one or two days. Among the conservative cases, 58.3 per cent at no time had a temperature over 100°.

The average hospital stay for the simple curetted cases was 11.6 days, and for the conservative cases 11.8 days.

Among the cases with a simple dilatation and curettage, those that were operated soonest after admission had the shortest course of postoperative temperature and hospital stay. In afebrile cases, therefore, especially in those who have had symptoms for some time, a deferred curettage has no special merit over an early one, other than that it gives more time to study the nature of the case.

Active and conservative treatment of incomplete abortion both have their place, as indicated in our experience. Patients with an unquestionable history of spontaneous abortion who are afebrile, especially if bleeding for some time, may well have the uterus actively and completely emptied of retained secundines. The particular method to be employed must needs be decided by the individual operator. In the hands of one surgeon a sharp curette can no doubt be used with as great a margin of safety as a blunt instrument in the hands of another. That gentle manipulation is essential is obvious.

In view of the greater morbidity and mortality experienced among febrile and complicated or doubtful cases with active treatment, these patients can best be treated expectantly until the temperature comes down, unless bleeding forces the hand of the surgeon, or, symptomatically, if the picture of a generalized sepsis emerges.

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PYELITIS AS A POSTOPERATIVE COMPLICATION

By William M. Maloney and Frederick H. Cracco
(Fourth Year Students, Cornell University Medical College)

THIS paper is based on a study of those cases in which pyelitis developed as a postoperative complication following gynecologic operations in the Woman's Hospital, New York, during the period of five years ending December 31, 1923. The data given were obtained from a study of the histories of these patients and not from bedside observations.

It has been observed in this hospital that pyelitis was occurring occasionally after gynecologic operations, and also that it was occurring with increasing frequency during the past year or two. These patients had no evidence of pyelitis when they entered the hospital. After operation their temperature was usually down to normal by the fifth day, convalescence progressed normally until after a varying length of time they would have a rather sharp rise in temperature of from 103° to 106°, accompanied by chills, tenderness in the kidney region, and painful micturition; pus soon appeared in the urine and the clinical picture was that of pyelitis. The temperature curve showed the usual fluctuations commonly seen in pyelitis and the condition persisted for periods of varying length, the shortest being two days and the longest twenty-nine days. One patient had two attacks before she left the hospital. The first occurred fourteen days after operation and lasted six days. After an interval of three days she had another short attack lasting three days.

In going through the histories all cases showing evidence of chronic pyelitis were excluded and only those cases in which pyelitis developed as a postoperative complication following gynecologic operations were accepted. In the five year period ending December 31, 1923, there were found twenty-four such cases and Table I shows how these cases were distributed over the five years and the percentage of the total gynecologic operations performed in this period.

Table I

YEAR	OPERATIONS	COMPLICATION OF PYELITIS	PER CENT
1919	1483	2	0.13
1920	1339	4	0.29
1921	1598	4	0.25
1922	1577	8	0.51
1923	1312	6	0.46
Total	7300	24	0.33

This study was undertaken for the purpose of determining, if possible, why this complication of pyelitis occurred, and in going through the histories of these twenty-four cases I have endeavored to consider all factors which might have any bearing on the problem.

From a study of Table II it will be noted that in regard to age, seven cases occurred in each of the second, third and fourth decades, and three in the fifth decade.

Twenty-one of these patients had been married and, of these, nineteen had borne one or more children. It is well known that pyelitis is a frequent complication of pregnancy, but none of these patients gave a history of pyelitis with any pregnancy. Information regarding the course of pregnancy and previous operations is given wherever it was available. Eight of these patients have a history of instrumental deliveries and nine had previous operations, of which at least seven were on the pelvic organs. The information regarding loss of weight and strength was not very definite but is given as far as it was available. It has been observed that viceroptosis is more common in thin, emaciated people than in those who are robust and well nourished. Ptosis of the kidney due to weakness of its attachments and lack of renal fat causes kinking of the ureter which retards drainage from the kidney and the resultant stasis is often an important factor in the etiology of pyelitis. However, none of the patients in this series gave a history of losing very much weight and consequently this factor can be ruled out.

The important points shown in Table II are (a) that twenty-one of the twenty-four patients were married and of these nineteen had had one or more pregnancies. (b) Instrumental deliveries and previous operations, especially those on the pelvic organs, and in this connection we must consider the possibility of a residual low grade infection being left behind which was stirred up by the recent operation just previous to the onset of their attack of pyelitis.

Table III gives the type of operation which these patients had just previous to their attack of pyelitis, also the surgical pathology found and the condition of the wound. The type of operation is similar in each case but some of those operative procedures were more extensive than others, and the surgical pathology is given as far as it was available in the histories. Infected wounds are a likely source of infection in pyelitis, as the infecting organisms can be carried by way of the blood stream to the kidneys; however, in this series infected wounds were not very numerous and the few that did occur soon cleared up.

Since pyelitis followed all of these operative procedures the question naturally arises as to just what part, if any, these operations played in the etiology of this complication. The trauma and shock of the operation would certainly lower the resistance of the patient

TABLE II

AGE	MARRIED OR SINGLE	NUMBER OF PREG.	COURSE OF PREGNANCIES	PREVIOUS OPERATIONS	ANY LOSS OF WEIGHT OR STRENGTH
50	Married	4	2 Instrumental	0	No loss of weight or strength
48	Married	1	Severe forceps	0	No loss of weight
39	Married	4	Forceps with first pregnancy	Laparotomy 1914	Slight loss of weight and strength
43	Married	4	Normal	0	None ?
32	Married	3	Normal	D and C and salpingo-oophorectomy	Information not given
42	Married	6	First and second instrumental	0	Loss of weight and strength
42	Married	6	Last was instrumental	Visceroptosis rt. kideny mobile for 4"	Information not given
52	Single	1	Normal	0	Best wt. 138 Present wt. 130
21	Single	0	– – –	Chronic salpingitis and adhesions	Lost 9 pounds in 8 months
31	Married	10	Normal	2 D and C	Lost 1 pound in two yr. Loss of strength
44	Married	11	Normal	0	Best wt. 150; now 138. No loss of strength
43	Married	9	First instrumental	1 D and C	Information not given
38	Married	7	First instrumental	Trachelo-plasty, perineor-rhaphy	Lost 8 pounds last month. No loss of strength
32	Married	7	Normal	0	? No loss of strength
33	Married	1	– – –	Abortion	? No loss of strength
53	Married	5	Normal	0	Lost 4 pounds one year ?
41	Married	2	Normal	0	No lost weight or strength
38	Married	4	Normal	0	No lost weight or strength
29	Married	1	– – –	0	No lost weight ?
29	Married	0	– – –	– – –	Information not given
27	Single	0	– – –	– – –	Lost weight for past year
28	Married	0	– – –	– – –	No lost weight or strength
24	Married	3	– – –	– – –	Information not given
24	Married	1	Instrumental	Appendicitis	No lost weight or strength

TABLE III

TYPE OF OPERATION	SURGICAL PATHOLOGY	WOUND
Supravaginal hysterectomy; Bilateral salpingo-oophorectomy; Rectocele and repair of pelvic floor.	Omental adhesions to bladder and fundus; Fibroid; Double salpingitis. Small ovarian cyst.	Serous and pus discharge
Amputation of cervix; Watkins operation; Left salpingo-oophorectomy; Repair of pelvic floor.	– – – –	– – –
Panhysterectomy.	Large myomatous uterus; Laceration of cervix and perineum.	Clean
Amputation of cervix; Ant. colporrhaphy; Repair of pelvic floor.	– – – –	Clean
Right oophorectomy; Separation of adhesions.	Cystic right ovary.	Clean
Repair of pelvic floor; Trachelorrhaphy.	Laceration of cervix; Relaxed perineum and rectocele.	Clean
Supravaginal hysterectomy; Bilateral salpingo-oophorectomy; Repair of pelvic floor; Amputation of cervix; Appendectomy.	Viceroptosis; Right kidney mobile 4".	Clean
	– – – –	Clean
Vaginal hysterectomy; Bissel's fascia lapping operation; Repair of pelvic floor.		Pus
Right salpingectomy; Operation for retroversion; Appendectomy.	Chronic salpingitis; Adhesions.	Staph. aureus Clean
D. and C.; Repair of pelvic floor.	Retroversion; Relaxed pelvic floor.	Clean
Exploratory laparotomy; Amputation of cervix; Cystocele; Repair of pelvic floor.	Cystocele; Relaxed pelvic floor; Accidental rupture of bladder.	– – –
Supravaginal hysterectomy.	Enlarged uterus; Small fibroids.	Clean
Appendectomy; Simpson's operation for retroversion.	Retroversion	Clean
Operation for cystocele; Repair of pelvic floor.	Large uterus.	Clean
Separation of adhesions; Bilateral salpingostomy; Appendectomy.	Tubes bound down.	Clean
Repair of pelvic floor.	– – – –	Clean
D. and C.; Amputation of cervix; Repair of pelvic floor; Rectopexy; Cystopexy.	Cystocele, rectocele.	Clean
Removal of cervical polyp; Amputation of cervix; Repair of pelvic floor.	Cervical polyp.	Clean
D. and C.; Low amputation of cervix; Operation for retroversion; Appendectomy.	– – – –	Clean
Left salpingo-oophorectomy; D. and C.; Ventral suspension.	Tuboovarian mass.	Clean
Post. colpotomy for pelvic abcess.	Pus in culdesac.	Clean
D. and C.; Right salpingo-oophorectomy; Left salpingectomy; Retroversion; Appendectomy; Separation of adhesions.	Fibro-cystic ovaries; Chronic salpingitis; Chronic periappendicitis.	Clean
Appendectomy.	Appendix.	
D. and C.; Separation of adhesions; Myomectomy; Appendectomy; Bilateral Salpingectomy; Ventral suspension.		

TABLE IV

PROXIMITY OF ATTACK TO DATE OF OPERATION	RELATION TO CONSTIPATION	RELATION TO CYSTITIS	FREQUENCY OF CATHETERIZATION
6 days after	Occasional constipation	– – –	Spontaneous urination 3rd day postoperative
7 days after	Slight constipation	– – –	Voided spont. 2nd day postop.; Cath. day before and 4 times per day after.
10 days after	Habitual constipation	– – –	Cath. day after operation. Voided spont. next day.
21 days after	Constipated	– – –	Self-retaining catheter inserted at operation.
14 days after	None	– – –	Cath. before operation and one day after.
15 days after	Mod. constipation	– – –	Cath. day after and 2 days later.
5 days after	None	– – –	Cath. before operation and for 4 days after operation.
12 days after	Mod. constipation	– – –	Cath. before and 3 times after operation. Voided spont. 2nd day.
7 days after	None	Mod. cystitis	Cath. 5 times in 2 days after operation.
8 days after	None	– – –	Cath. day of operation. Voided spont. next day.
3 days after	Constipated for 2 or 3 days	– – –	Cath. twice day of operation and 5 times next day.
Same day	Mod. constipation	– – –	Self-retaining catheter inserted at operation.
4 days after	Constipated	– – –	Cath. 9 times in 5 days after operation.
4 days after	None	– – –	Cath. 7 times in next 3 days after operation.
14 days after	Mod. constipation	– – –	Cath. twice before and 18 times after operation.
5 days after	Diarrhea	– – –	Cath. twice same day and 11 times in next 5 days.
5 days after	Mod. constipation	– – –	Cath. 15 times in first 5 days after operation. Voided spont. 5th day.
Same day	Mod. constipation	– – –	Cath. 6 times in 2 days after operation.
8 days after	Constipated	– – –	Cath. same day and 41 times during next 14 days.
4 days after	Mod. constipation	– – –	Cath. frequently in 4 days after operation. Voided spont. on 5th day.
5 days after	Mod. constipation	Cystitis	Cath. twice same day. Voided spont. next day.
4 days after	Chronic constipation	– – –	Voided spont.
19 days after	Mod. constipation	– – –	Cath. once before operation and 6 times in next 2 days.
6 days after	Constipated	– – –	– – – –

against infection to a very considerable extent and foci of infection (if present), which would be held in control under normal conditions, would now have an opportunity of starting lesions in other regions of the body and especially in the kidney. Also in cases of salpingitis a low grade of infection usually persists in this region after the acute process subsides. Operations for the relief of this condition are likely to stir up this infection, which gets to the kidney by way of the

blood stream, and may cause pyelitis. The same would apply after operations for appendicitis. It is also to be noted that the pelvic floor was repaired in twelve or half of these cases. The field of this operation is far from being sterile and it is possible that infection may have been introduced in at least some of these operations, which later reached the kidney and caused the pyelitis, but I cannot supply any definite proof that this actually occurred. Just how much importance we are justified in assigning to this possibility must, for the present at least, remain a matter of speculation.

From a study of Table IV it will be seen that in two cases the attack occurred the same day as the operation. In the rest of the cases the earliest onset was three days after and the latest was twenty-one days after the operation. The average period elapsing between operation and onset was 7.3 days. Eighteen of these patients gave a history of constipation before operation and the colon bacillus was present in twenty-one out of the twenty-four cases. This prevalence of the colon bacillus can be accounted for by the fact that the cecum and ascending colon have lymphatic connections with the right kidney which are not found on the left side and, also, this organism can reach either kidney by way of the blood stream. From these facts it is pretty clear that in constipation we have one of the chief causes of pyelitis.

Catharsis is sometimes considered as a possible cause of pyelitis. In general, these surgical patients get a cathartic (usually castor oil) forty-eight hours before operation and an enema the morning before operation. On the fourth day after operation they get a cathartic (usually castor oil) followed by an enema in four hours if necessary, and during convalescence mild cathartics if necessary. This routine is modified to meet the requirements of the different cases. Catharsis removes any existing constipation and in this respect it is beneficial since constipation is an active cause of pyelitis. But is catharsis in any way a possible cause of pyelitis? Alvarez[1] states that "bacteria in solid feces are for the most part dead, while those in liquid evacuations are alive and possibly increased in virulence. Solid feces tend to restrain the growth of pathogenic bacteria in most people. In typhoid carriers it is almost impossible to grow bacteria from solid stools but after purgation liquid feces may be swarming with them. The intestinal flora is evidently changed by purgation, possibly because the B. coli lose their restraining effect on pathogenic bacteria. Also purgation may make the bowels more permeable to bacteria." I cannot find any experimental proof to verify the theory quoted above but, assuming for the moment that it is correct, then we should have had many more cases of pyelitis following operations than we did have in this hospital. In the five year period ending December 31, 1923, there were 7,300 gynecologic operations and of these only

24 cases developed pyelitis following operation, yet every case had about the same amount of catharsis. It would therefore appear that this theory regarding catharsis does not hold, and until some definite proof is at hand I don't think we can consider catharsis as an active cause of pyelitis.

Cystitis was recorded in only two cases and was most likely the result of the existing pyelitis rather than its cause.

Catheterization is sometimes considered as a possible cause of pyelitis. Table IV shows that these patients were usually catheterized once before operation and as often as necessary after operation until they voided spontaneously. Since it was done under sterile precautions I think we can safely eliminate it as a cause of pyelitis, and since it prevented retention during a period when the urine contained bacteria it seems reasonable to consider it as a prophylactic measure against pyelitis rather than a possible cause. Rawls,[2] studying forty cases of colon bacillus pyelitis, states, "My series is too small to draw definite conclusions but we are justified in assuming that in a rather large percentage of gynecologic conditions we have a bacilluria and that in the great majority the microorganisms are in the rôle of saprophytes. If, however, we have conditions present which cause stasis in the urinary tract and to this is added either in our operative procedure or in our after-care trauma or unanatomic conditions then the organisms become pathogenic and we have a pyelitis, pyelonephritis, cystitis and even systemic infection. This is especially true of B. coli."

From a study of Table V it will be noted that with one exception each case had just one attack of pyelitis. The duration of these attacks varied from two days up to twenty-nine days, the average duration being twelve days. B. coli was the organism most often found. It occurred alone in eighteen cases, with Staphylococcus albus twice and with streptococcus once. The information as to whether the pyelitis was in right or left kidney or bilateral was given in only five cases and of these it was in the right kidney in three cases and bilateral in two cases. Pyelitis occurs more often in the right kidney than in the left, which is evidently due to the fact that the right kidney has lymphatic connections with the cecum and ascending colon not found on the left side. Nast[3] in an analysis of a series of 757 cases of pyelitis found it to occur in the right kidney in 61 per cent of the cases, left kidney in 9 per cent and bilateral in 30 per cent.

Regarding treatment these patients were kept in bed, given a light diet and quantities of fluids. The only medicinal treatment given was acid sodium phosphate and urotropin. Two cases had bladder irrigations and the last two cases had high colonic irrigations in addition to the above-mentioned drugs. Two cases did not get any drug treatment and, although the infecting organism was not B. coli, these cases

TABLE V

NUMBER OF ATTACKS	DURATION OF ATTACK	ORGANISM	RIGHT, LEFT OR BILATERAL	TREATMENT
1	22 days	B. coli	Right	Acid sod. phosphate and urotropin
1	3 days	B. coli	Information not given	" " "
1	6 days	B. coli	?	" " "
1	3 days 6 days	B. coli	?	" " "
2	3 days	B. coli	?	Sod. benzoate and urotropin
1	2 days	B. coli	?	Acid sod. phosphate and urotropin
1	2 days	B. coli	?	Acid sod. phosphate and urotropin
1	26 days	Staph. albus B. coli	?	Acid sod. phosphate and urotropin
1	14 days	B. coli	?	Acid sodium phosphate and urotropin
1	7 days	Staph. albus	Bilateral	None
1	11 days	B. coli	Bilateral	Acid sod. phosphate and urotropin
1	13 days	B. coli and staph.	Right	Bladder irrigated with boric sol. and sod. phos. and urotropin after attack subsided
1	2 days	L. acidophil-aërogenes	?	None
1	9 days	B. coli	?	Acid sod. phosphate and urotropin
1	5 days	7/26 B. coli and strep 7/31 B. coli	?	" " " "
1	7 days	B. coli	Right	" " " "
1	29 days	B. coli	?	" " " "
1	20 days	B. coli	?	Bladder irrigated with $AgNO_3$ and argyrol; Acid sod. phos. and urotropin.
1	13 days	B. coli	?	Acid sod. phosphate and urotropin
1	18 days	B. coli	?	" " " "
1	16 days	B. coli	?	" " " "
1	17 days	B. coli	?	" " " "
1	12 days	B. coli	?	" " " "
1	14 days	Gram-negative spore-bearing bacilli	?	High colonic irrigations Acid sod. phos. and urotropin
1	17 days	B. coli	?	High colonic irrigations Acid sod. phos. and urotropin

cleared up spontaneously in seven and two days respectively, which was well within the average duration of these attacks. This occurrence would cast some doubt on the efficiency of acid sodium phosphate and urotropin in the treatment of pyelitis.

The chief etiologic factors of pyelitis following operations as shown by a studies of the histories of these cases are: (1) Constipation; (2) operations for relief of chronic conditions such as appendicitis and salpingitis; (3) operations on the pelvic organs such as hysterectomy, ovarectomy, etc.; (4) operations around the rectum such as perineorrhaphy, and (5) lowering of the patient's resistance (general

and specific) to infection. Kretschmer[4] in reviewing 200 cases of pyelitis states that 30 per cent of these patients gave a history of constipation of varying degree for which laxatives and purgatives were freely used. In a small number of cases the patients suffered from lesions of the rectum such as hemorrhoids and from lesions of the anus such as fissures and fistulae. Sixty-one per cent of the cases occurred in females and 39 per cent in males.

Several other possible causes, not mentioned in the histories of these cases, should be considered before we dispose of the subject of etiology. It is often stated that pyelitis results from ascending infections; but there is considerable difference of opinion as to the route the infection follows if it actually does ascend to the pelvis of the kidney. (a) It has been claimed by some that where a cystitis exists the infection may spread upward by continuity along the mucosa of the ureter and thus reach the pelvis of the kidney. If such were the case we should expect to find pyelitis present in the large majority of the cases having a primary cystitis, but such a condition is not found, and in the absence of any experimental evidence to support this theory I think we can safely eliminate it without further comment. (b) It is also claimed that infections ascend from the urethra and bladder to the kidney by way of the lymphatics. That this actually occurs was shown by Walker[5] in animal experiments on guinea pigs. He inoculated the urethra with certain bacteria and found he could recover these bacteria in twelve hours from the tissues at the upper end of the ureter. He also found round-cell infiltration under the capsule of the kidney and concluded that the kidney was infected by way of the lymphatics. He showed that the infection traveled in the lymphatics by inoculating the urethra with carmine and later by microscopic section located the carmine particles in the lymphatics which lie just outside the urethra.

Draper and Braasch[6] quote experiments by Emberton and Thiele showing that the kidney is not infected direct by way of the lymphatics as stated above. Bacteria were placed in the urethra of animals and they showed that these bacteria were absorbed into the lymphatics of the urethra and traveled upward in these vessels passing over the wall of the bladder and up along the ureters collecting under the capsule of the kidney but not infecting the kidney at this point. They passed through the lumbar glands and into the thoracic duct and then into the blood stream reaching the kidney in this way. If the thoracic duct was cut they did not reach the kidney or appear in the urine; therefore, they concluded the bacteria reached the kidney by way of the blood stream. (c) It is also claimed that ascending infections occur by a reflux of infected urine up the ureters. Quimby[7] states that this is liable to occur in those cases where the ureterovesical valve is defective following cystitis. That ureteral re-

flux occurs has been demonstrated by fluroscope after filling the bladder with opaque fluids. Draper and Braasch[6] have shown that this type of ascending infection is possible but exceptional and occurs only in those cases presenting marked changes in the vesical orifices of the ureters.

Focal infection must not be overlooked as a possible cause of pyelitis but the histories of these patients gave practically no information regarding the existence of foci of infection. A focus of infection such as an apical abscess or an infected tonsil, etc., may be present but is held in check by the normal body resistance to infection. On account of the marked lowering of this resistance which followed extensive operations for the relief of their pelvic conditions, the organisms from such a focus may then be able to set up an infection in other regions of the body, such as the kidney, and consequently we are unable to determine to what extent focal infection was a factor in the etiology of these cases as the information regarding the existence of such foci of infection was not given in the histories.

The normal kidney is able to excrete colon bacilli and other similar organisms without any evidence of damage and I think that in a large number of cases of so-called "colon bacillus pyelitis" the damage to the kidney was originally caused by organisms such as streptococci or staphylococci from foci of infection in other parts such as teeth, tonsils, sinuses, etc. The soil having been prepared, the colon bacillus gets established and grows so rapidly that it crowds out the original invader and is the only organism found when the condition of pyelitis is well established. That such foci of infection have an important place in the etiology of pyelitis has been proved by the excellent experimental work of Bumpus and Meisser.[8] In a large series of careful animal experiments they have shown that organisms such as green producing streptococci found so often in apical abscesses of teeth and also at the roots of devitalized teeth which show no evidence of abscess on x-ray, when injected intravenously into rabbits always produced a localized infection in the kidneys such as small necrotic areas but never a diffuse nephritis. The same results were obtained with organisms from the tonsils of these patients and after 82 careful animal experiments they conclude that pyelonephritis may often be due to focal infections harboring streptococci which have a selective affinity for the urinary tract and that the colon bacillus which is commonly found and generally believed to be the cause is of secondary importance. Rosenow and Meisser[9] confirmed the work of Bumpus and Meisser and showed they could produce pyelitis in dogs by infecting the teeth. The teeth were bored into, infected, and sealed up. Nothing further was done and almost without exception they developed pyelitis. Helmholz and Milliken[10] studied four cases of infection in children having badly infected tonsils, otitis media, and

carious teeth followed by pyelitis. Cultures of staphylococci and streptococci from these sources of infection were injected into rabbits which developed pyelitis. They find that these organisms from the throat have a greater tendency to localize in the kidney than do colon bacilli from the urine. Helmholz and Beeler[11] showed that colon bacilli from the urine of human cases of pyelitis injected into rabbits localized in their kidneys in only 12 per cent of the cases.

Bumpus and Meisser[12] investigated six cases which came to the Mayo clinic for relief of symptoms indicating a pyelitis. On careful physical examination they found defective teeth in four cases and infected tonsils in two cases. These defective teeth and tonsils were removed and cultures made from them which showed a green producing streptococcus and which was injected into many rabbits. In nearly all these animals they found destructive lesions in the kidneys which confirmed their conclusions mentioned above, viz., that pyelonephritis may often be due to focal infections harboring streptococci having a selective affinity for the urinary tract and that the colon bacillus which is commonly found and generally believed to be the cause is of secondary importance.

From these investigations it is evident that focal infection may be a very important factor in the etiology of some cases of pyelitis and consequently should receive due attention in physical examination. The tendency of some cases of pyelitis to persist may be due to a focus of infection which caused the pyelitis in the first place. Unless such a focus is located and removed treatment of the local condition in the kidney will not effect a cure.

Hill[13] states that strictures of the ureter occur more frequently than is realized. The obstruction caused to the free drainage of the kidney in these cases results in keeping bacteria in the pelvis of the kidney long enough to do damage. Whenever a positive urine culture persists he advises cystoscopy and ureteral catheterization.

The pathology of pyelitis varies from an inflammation of the pelvis of the kidney associated with a mild degree of nephritis to a total destruction of the kidney and between those two extremes there are many gradations. Since there is always some degree of nephritis present, I think the condition should be described as a pyelonephritis rather than pyelitis.

Treatment aside from general measures such as rest in bed, light diet, quantities of fluids, there is some difference of opinion as to the best method of treating pyelitis. The drugs which have been used for the relief of this condition have not been very satisfactory. The popular remedy of urotropin with acid sodium phosphate is often without any apparent effect in limiting the course of the disease and this is especially true in the case of colon bacillus pyelitis. Some have tried giving alkalies for the first ten days and then changing abruptly

to acid sodium phosphate and urotropin in the hope that they would inhibit the growth of colon bacilli by changing from alkaline to acid medium, but it has been demonstrated that this organism can grow in either an alkaline or acid medium and also that it is practically impossible to make the urine acid enough to inhibit the growth of B. coli. Crabtree[14] in studying the treatment of acute pyelonephritis due to B. coli with alkalies, urotropin, etc., states that we are justified in considering acute colon pyelonephritis as a self-limited disease in which the aim of the physician is to contribute to the comfort of the patient and give those drugs which are best tolerated by that particular patient. Also cystoscopy should be avoided during the acute stage. Helmholz[15] states that in acute cases of pyelitis alkalies are useful but we have no evidence of any direct specific action, also that urotropin has a very definite bactericidal action in the bladder but whether this applies also to the pelvis of the kidney has not been demonstrated.

Of all the methods tried in the treatment of pyelitis that of pelvic lavage appears to be the most satisfactory. Kretschmer[4] states that pelvic lavage undoubtedly heads the list as far as efficiency is concerned. In this procedure he uses drugs such as mercurochrome, silver nitrate—0.5 per cent to 5 per cent, collargol and argyrol. He advises that care should be used not to overdistend the kidney pelvis. In the average case from 8 to 10 c.c. were used and pelvic lavage was repeated twice per week until the urine was sterile and free from pus.

In some cases where pyelitis occurs in a ptosed kidney with kinking of the ureters the mere insertion of a ureteral catheter which straightens out the kinks and permits good drainage is all that is required.

Hirst[16] states that palliative treatment does not accomplish anything and is usually a waste of time. Active treatment by pelvic lavage is the most efficient method. Solutions used were silvol, 10 to 15 per cent or neosilvol "which gave no evidence of pain or of secondary irritation."

With reference to the various drugs used in pelvic lavage the question arises as to just what effect these drugs may have on the kidney pelvis and other portions of the kidney with which they come in contact. O'Connor[17] did some interesting experiments on dogs in which he tested the effect of these various drugs on the renal epithelium by pelvic lavage using syringe and gravity method. He studied the effect of these drugs on the tissue by microscopic section at periods varying from forty-eight hours up to fourteen days after pelvic lavage. He found that boric acid solution produced no abnormality of tissue in the ureter, pelvis, or kidney. Aluminum acetate, 2 per cent, retained thirty minutes after syringe injection also produced no changes. Silver nitrate, 0.5 per cent, was used by

both methods on ten dogs and kidneys were examined at periods varying from forty-eight hours up to fourteen days. The immediate effect was a uniform corrosion of ureteral and pelvic epithelium. The reaction was somewhat more marked with 1 per cent solution but the penetration and corrosion of the medullary tips was the same with both solutions. Metallic silver was found in every instance in the more distal portions of the collecting tubules but never above the collecting tubules. After forty-eight hours the pelvic and ureteral mucosa was partially denuded and irregular. Four days after injection the mucosa of ureters and pelvis was entirely destroyed with the exception of a few scattered areas. Six days after, disintegration of epithelial cells had ceased and mucosa was being regenerated by a bridging over of the epithelial layers. Ten days after, the epithelial lining was completely regenerated. Mercurochrome 220 was used in 1 per cent solution. There was no loss of surface epithelium but there were areas in which the nuclei of superficial cells were disintegrated. The dye ascended the tubules for varying distances in some cases surrounding the glomeruli. Forty-eight hours after lavage no dye was found in the tubules or pyramidal tips. Surface epithelium of the pelvis and ureter was intact, the submucosa and muscularis were stained a deep red. There was no round-cell reaction, and the dye remained in these tissues from five to seven days.

These experiments show that considerable care must be exercised regarding the concentration of drugs used in pelvic lavage and this is particularly true of silver nitrate, also that mercurochrome is the most penetrating of the drugs used.

CONCLUSIONS

1. The chief etiologic factors of pyelitis following gynecologic operations are:

(a) Lowering of patients' resistance (general and specific) to infection due to trauma and shock of operation.

(b) Constipation.

(c) Operations for relief of chronic disease.

(d) Operations on the pelvic organs and around the rectum.

(e) Focal infections.

(f) Ascending infections by way of the lymphatics or by ureteral reflux.

2. The question of focal infection should receive careful attention on physical examination.

3. That such drugs as alkalies, urotropin, etc., usually used in the treatment of pyelitis are inefficient.

4. That pelvic lavage is the most efficient treatment for pyelitis.

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